GEAR MEASURING INSTRUMENTS

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SEP 11 1968

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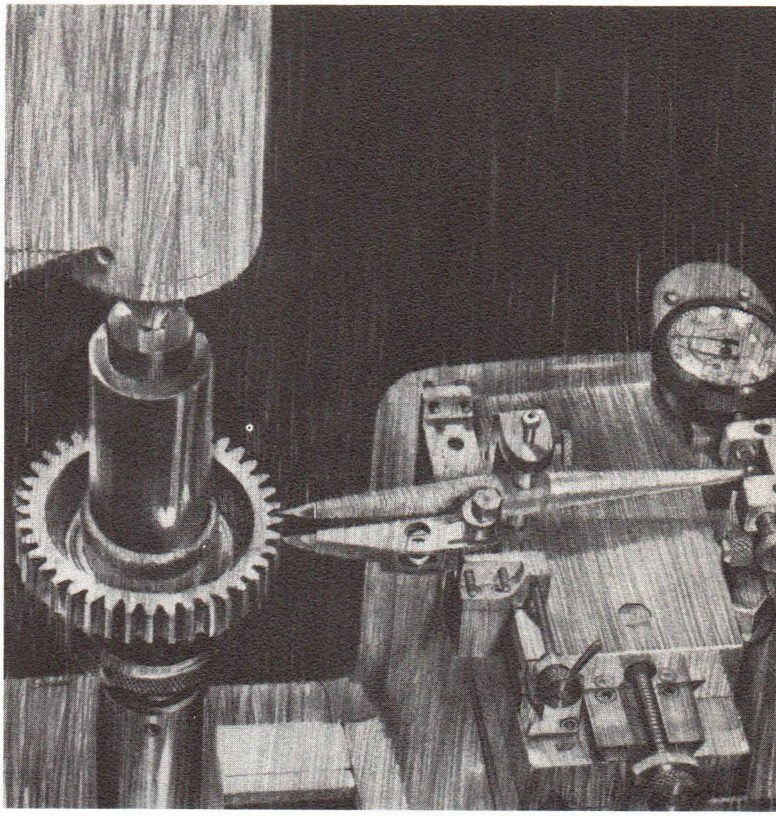

itw

itw gear measuring instruments are important tools available to the production department to assure a high level of uniformity and maximum output at acceptable quality control levels.

Functional gear checking equipment on the production floor, from simple rolling fixtures to completely automated inspection machines, serves as an on-the-spot signal that production gears are within tolerance limits.

Analytical inspection equipment in the gear lab provides the "reasons why" gears are outside tolerance limits and assists the production foreman in making corrective adjustments in tooling, machine-set-up, etc., to hold production pieces to prescribed tolerance limits.

In high quantity production particularly —reduced rejects and savings in operator and machine time more than off-set the cost of the inspection equipment installation, and provide improved product quality through quieter, more accurate gears as well.

In job shops, proof of accuracy in the form of recorded charts creates customer confidence and satisfaction.

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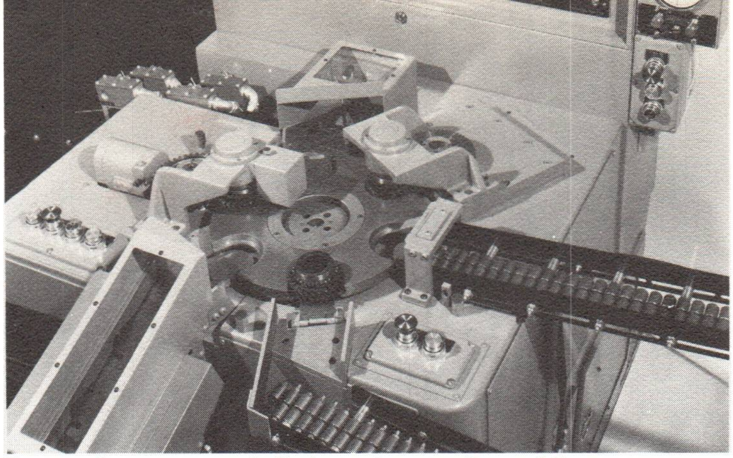

Close-up of rotary automatic final gear inspector (See p. 26)

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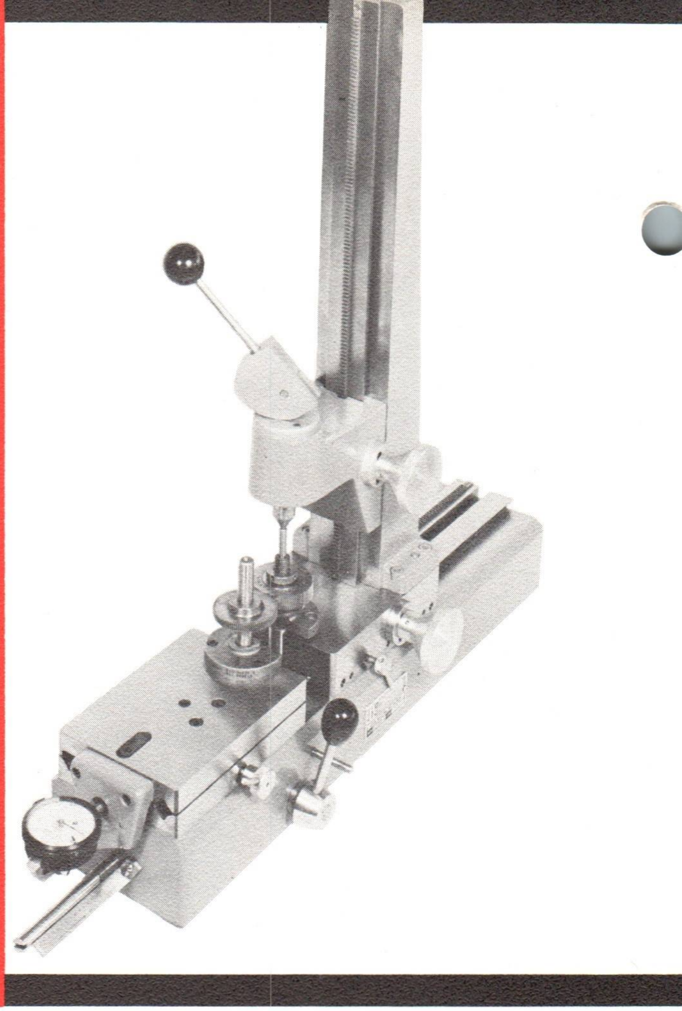
Specifications found in this catalog subject to change without notice.
Manufacturer reserves the right to improve product design at any time.



2200 Series Functional Gear Rolling Instruments

Simple, accurate, versatile — parallel axis gear instruments offer economical quality control on the production floor.

ITW parallel axis gear rolling instruments make gear checking fast and easy — the production gear is simply rolled with a suitable master of known tolerance. This provides a true functional picture of gear accuracy without complex measuring or gaging. Equipped with an inexpensive mechanical recorder, the unit will furnish a permanent visual total composite record of gear quality which can be analyzed for tooth spacing, involute or runout deviations.

Units are readily adaptable to in-process quality control on the production floor, thereby cutting costly rejections. On-the-spot checks give warning of errors in machine set-up or tooling.

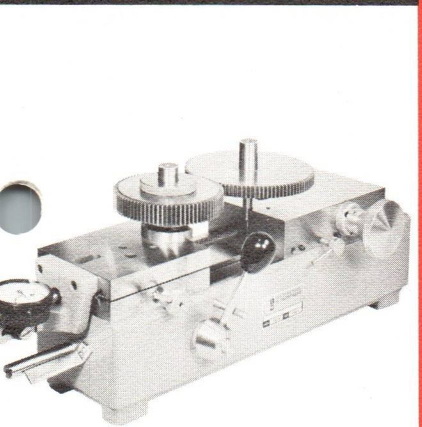
The basic unit checks spur and helical gears, and can be equipped with accessory attachments for checking worm, internal, and bevel gears as well.

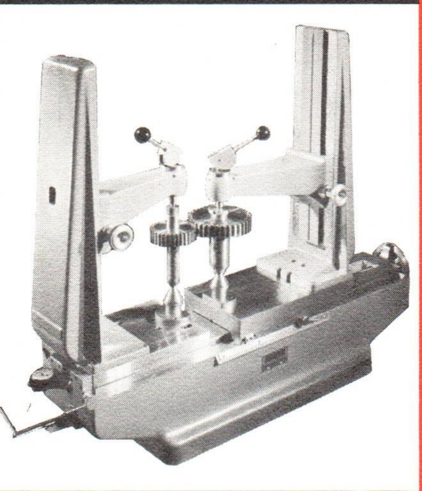
10 models provide capacity required for most production gear runs.

10 BASIC MODELS FILL ALMOST ANY GEAR ROLLING REQUIREMENT

STUD TYPE	No. 2203	No. 2206	No. 2209	No. 2212	No. 2215
RATED CAPACITIES					
Maximum center distance	3″	6″	9″	12″	25″
Minimum center distance	⅜″	⅜″	¾″	2″	3″
Maximum movement of floating unit	5/16″	⅝″	⅝″	⅞″	⅞″
Maximum recommended gear diameter	5″	10″	15″	18″	26 to 44″
Instrument weight	30#	50#	75#	200#	500#
COLUMN TYPE	No. 2203-1	No. 2206-1	No. 2209-1	No. 2212-1	No. 2215-1
RATED CAPACITIES					
Maximum center distance	3″	6″	9″	12″	20″
Minimum center distance	⅜″	⅜″	¾″	2″	3″
Maximum distance between vertical centers	6″	9″	15″	18″	18″
Maximum movement of floating unit	5/16″	⅝″	⅝″	⅞″	⅞″
Maximum gear diameter between vertical centers	4″	6″	6″	9″	24″
Instrument weight	40#	90#	90#	275#	600#

***Note:** Models #2212 and 2215 have screw for moving calibrated slide and direct reading calibrated scale for setting center distance. Models #2203 thru 2215 require 2 stud type arbors for holding master and work gears. Models #2203-1 thru 2215-1 are furnished with vertical centers and require one stud type arbor. All stud type arbors will be quoted as accessories according to part and master gear specifications. Specifications of stud-type arbors can be furnished to customers who wish to make their own arbors.





All models can be equipped with 2 columns and overarms as shown. When ordering or requesting quotation, submit detailed prints of part to be checked and mating parts. Adequate fixturing will be quoted.

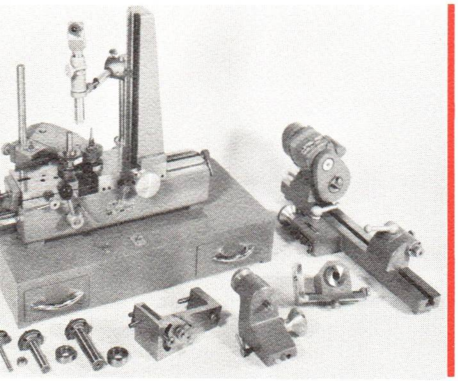


Illustration above shows the complete 2200 Series package except for recording. Instrument base is special—ordered by the customer to house miscellaneous arbors, master gears and other tooling. Microscope is also special—used to observe tooth action.

A basic unit with attachments fills almost any gear inspection need

RIGHT ANGLE ATTACHMENT:

This accessory replaces the standard capacity slide of the basic unit and provides means for checking worm and other Right Angle axis gears. Standard unit is equipped with motor drive.

BEVEL GEAR HEAD:

The head is quickly and easily mounted to the floating or capacity slide of the basic unit and provides a right angle shaft mounting means for checking bevel gears.

INTERNAL GEAR FIXTURES:

Generally, the unit consists of a column and over-arm which is easily mounted to the stationary slide of the basic unit as shown. Tooling to locate and hold the ring gear is mounted to the floating slide.

MOTOR DRIVE:

The motor drive is sometimes used without recording to power master gear at uniform speed. Motor Assembly covers full capacity range of each basic unit and mating accessories.

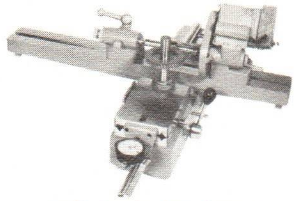
Motor drive is recommended when using the #1650-14 Mechanical Recorder.

MECHANICAL RECORDER:

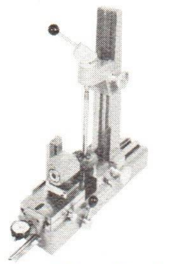
Provides visual chart of overall gear quality. 400:1 chart may be analyzed to determine corrective adjustments required on production machines.

MISCELLANEOUS ACCESSORIES:

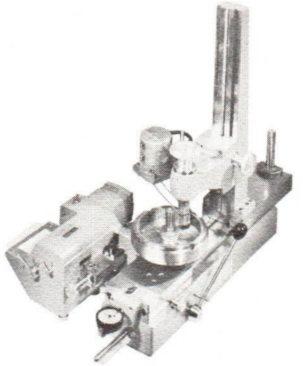
A wide range of centers, arbors, studs and work holding fixtures can be supplied to fill special applications.



Right Angle Attachment

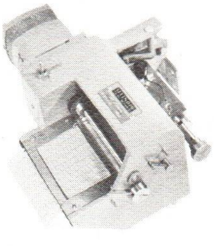


Bevel Gear Head



Internal Gear Fixtures

Motor Drive



Mechanical Recorder

Miscellaneous Accessories

Production-type Gear Rolling Instruments

An economical gear rolling instrument designed for rugged production use

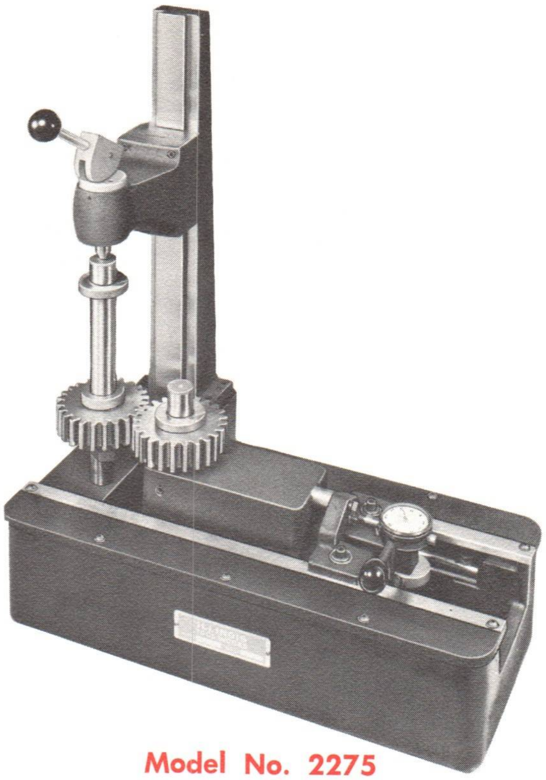
This unit, available in both stud arbor and column and over-arm models features rugged construction and tough finish. It is designed to take production floor abuse day-in and day-out without affecting instrument accuracy. The 2275 is ideal for on-the-spot quality control at the gear cutting machine—saving repeated trips to the inspection lab for checks on production equipment and tooling.

The unit also finds wide use in smaller gear job shops where flexibility, low cost and long life are prime requisites.

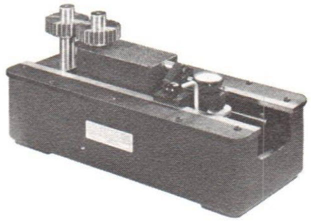
The 2275 requires only a suitable master for the check. Errors in the work gear are reflected as center distance variations by means of a .0005 dial indicator.

Low cost permits wide use of the instrument in production-type quality control applications.

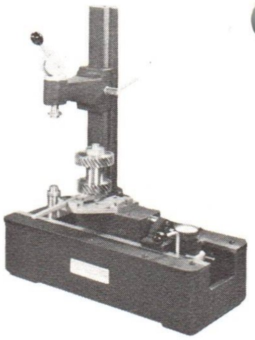
Special fixturing for quick indexing or for checking cluster gears are quoted as accessory equipment.



Model No. 2275



Stud arbor-type production gear rolling instrument. The simplest and most economical instrument in this series.



Unit above shows special adaptation of the basic production-type hand roller tooled to check a cluster gear. An example of the many possibilities of this simple, versatile instrument.

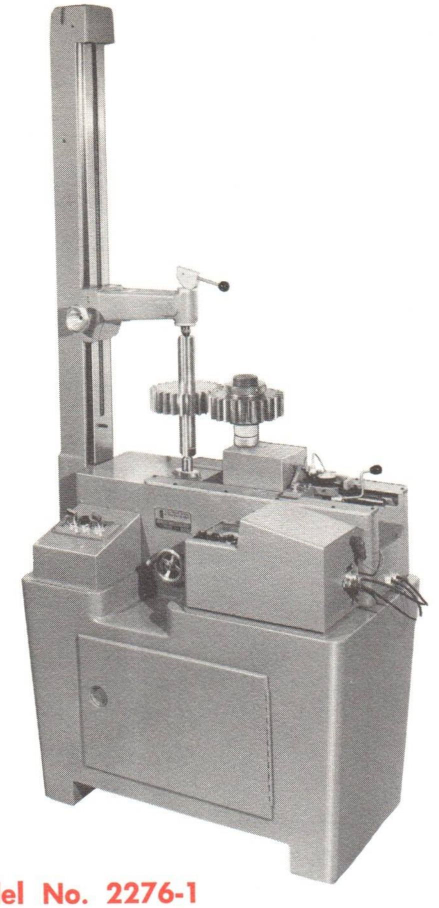
CAPACITIES	Stud Arbor Type #2275	Column Type #2275-1
Maximum center distance	9″	9″
Minimum center distance	2″	2″
Maximum gear diameter	16″	12″
Maximum distance between vertical centers		15″*
Maximum movement of floating unit	⅞″	⅞″
Throwout for loading	¾″	¾″
Master and work gear vertical adjustment	3″	3″
Adjustable floating unit spring tension	2.2 to 15 lbs.	2.2 to 15 lbs.
Overall weight of unit	120 lbs.	160 lbs.
Overall height	8″	31½″

Overall length 27½″ Overall width 14¾″

*30″ column available

Gear Charter

Combines flexibility of functional composite checking with electronic recording



Model No. 2276-1

NOTE: Non-recording models and those to be used with separate recording can be supplied without cabinet base for use as a bench instrument. All integral recording instruments are available as floor models only.

The 2276 Gear Charter is a sturdy, precise, motor driven instrument equipped with famous ITW electronic recording, yet priced comparably with units employing linkage-type mechanical recording.

Solidly built, the 2276 is especially adapted to rugged production line use for "on the floor" inspection, while retaining all the precise accuracy required for laboratory inspection use.

The instrument is available with several options: with or without recording, motor drive, or column and overarm. When provided without column and overarm, a simple alteration increases gear diameter capacity to 40″.

When equipped without electronic recording, this unit can be supplied as a bench-type instrument.

A simply operated reversible spring pressure device is added to adapt the floating slide unit to internal checking.

CAPACITIES	Model No. 2276	Model No. 2276-1
Maximum Gear Diameter	24″	24″
Maximum Center Distance	15″	15″
Minimum Center Distance	2⅝″	2⅝″
Maximum Distance Between Vertical Centers	—	30″
Minimum Distance Between Vertical Centers	—	0″
Throwout movement for loading	⅝″	⅝″
Lower Center or Stud Arbor Vertical Adjustment	6″	6″
Master Gear Spindle Vertical Adjustment	4″	4″
Overall Dimensions		
Maximum Length	43″	49″
Maximum Width	24″	24″
Maximum Height	53″	84″
Weight	1100#	1300#

CHECK THESE PLUS FEATURES:

INSTANTLY REVERSIBLE MOTOR DRIVE

Convenient feature permits spot analysis of gear segment without making complete revolution of the gear spindle.

UPPER CENTER CAM RELEASE

Cam release of upper center permits quick loading and unloading without changing set-up.

VERTICAL ADJUSTMENT

Master gear spindle has 4″ adjustment, lower center has 6″ adjustment for complete flexibility.

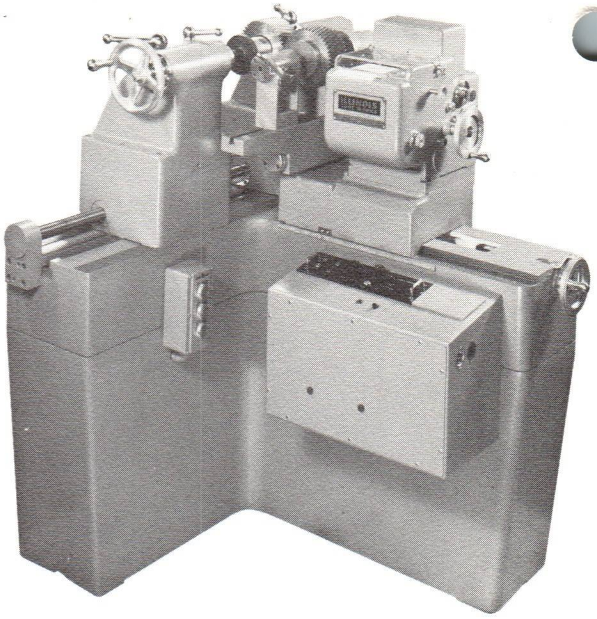
THROW-OUT LOADING LEVER

Permits loading work pieces without changing center distance set-up.

Parallel Axis
Gear Charter

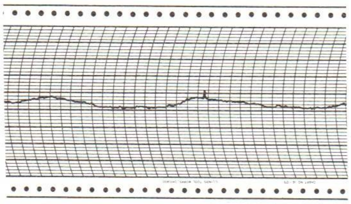
FAST, ACCURATE CHECK FOR SIZE VARIATION AND RUNOUT

Charting produces a true picture of the manner in which gears roll or function. In practice, the gear to be tested is rotated against a ground master of known accuracy. Variations in center distance are recorded on the chart. These charts produce a true picture of gear size variation and runout. Further analysis will determine involute spacing or lead errors. An experienced operator can quickly evaluate the chart for these deviations.



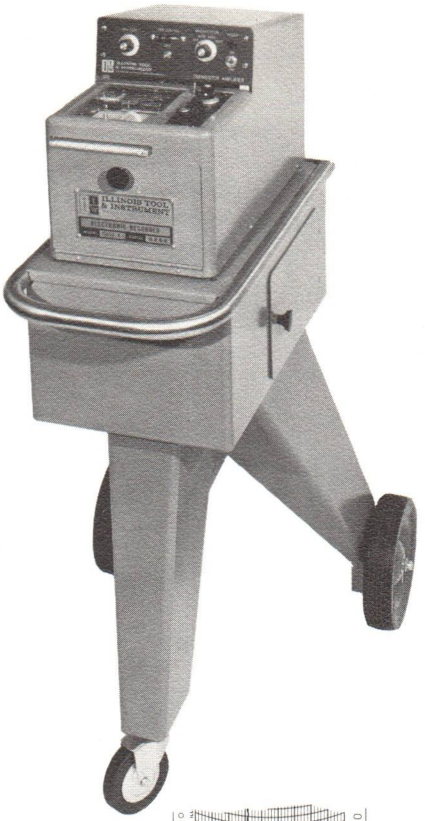
Model No. 3518

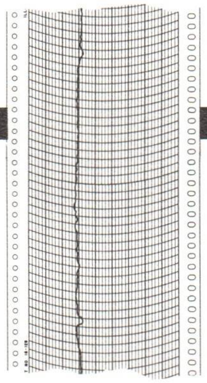
TYPICAL COMPOSITE CHART



CAPACITIES			
MACHINE CAPACITIES	**3509**	**3516**	**3518***
Maximum Center Distance Between Front and Rear Centers	9″	16″	18″
Minimum Center Distance Between Front and Rear Centers	3½″	4″	4″
MASTER GEAR CENTERS			
Maximum Gear Diameter	6″	9″	12″
Maximum Length Between Centers	9″	12″	12″
Minimum Length Between Centers	3″	3″	3″
WORK CENTERS			
Maximum Gear Diameter	12″	24″	30″
Maximum Length Between Centers	21″	36½″	36½″
Minimum Length Between Centers	0″	0″	0″
FLOATING UNIT			
Maximum Indicator Movement	.150	.150	.150

*Motorized work holding head and tail stock





Model No. 1605

Recording

Recording provides accurate gear checking more quickly, more reliably than dial readings.

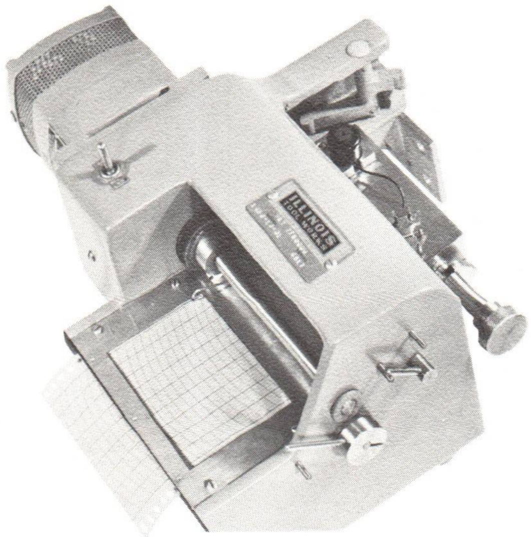
ELECTRONIC RECORDING

The ITW #1605 is a rapid response, solid state, electronic recorder designed for long continuous duty. Extremely accurate, the unit offers a choice of amplification: 200:1, 400:1 and 800:1.

For specialized work, this unit is available in magnifications of 2000:1, 4000:1 and 8000:1.

Electronic recording provides a permanent, easy-to-read record of the part. Charting is particularly useful since the pattern produced reveals the cause as well as the amount of the error.

The 1605 is an extremely flexible unit and combined with electrical pick-up head it can be used with all ITW gear measuring instruments not equipped with integral recording. Highly portable, the instrument is quickly rolled to any unit on the lab floor. Set-up is quick and easy using a simple plug-in connection. Often these recorders are used to serve several inspection instruments. The same unit, less buggy, serves as the recording device for ITW integral recording instruments.



Model No. 1650-14

U.S. Pat. No. 2,780,006

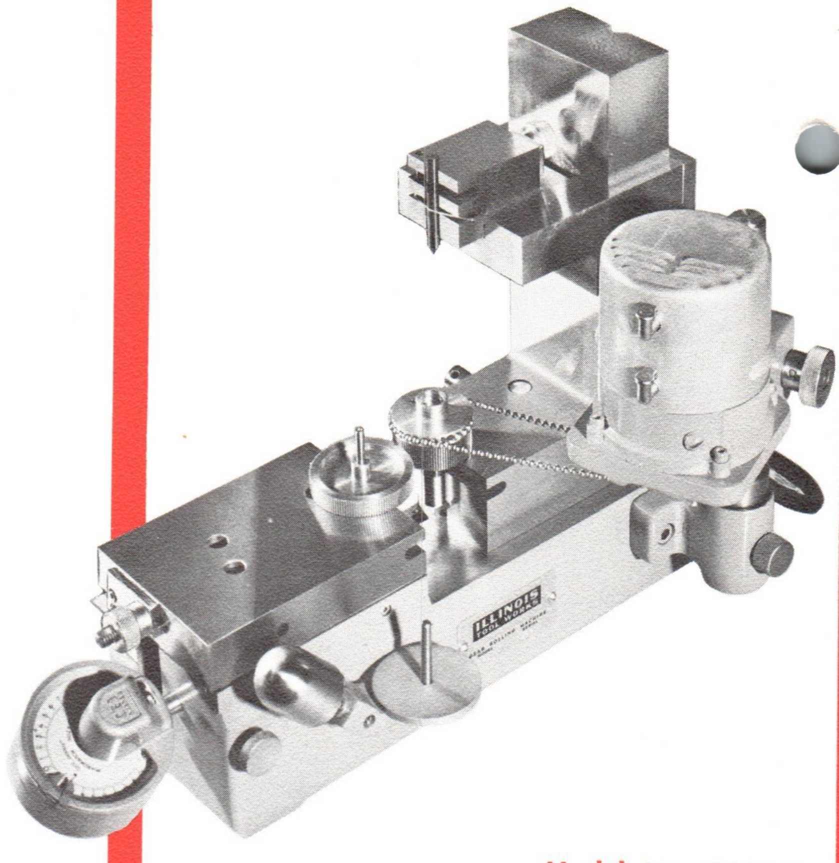
MECHANICAL RECORDING

The 1650-14 is an economical unit and provides a graphed chart for functional gear measuring instruments. The unit is designed with mounting bracket and is attached with bolts to the base of the instrument. The recorder permits minimum center distance gear checking and uses a separate drive motor which is furnished with the standard unit.

Amplification 400:1

Precision Fine Pitch Gear Rolling Instrument

A complete precision fine pitch gear lab with one basic unit and accessories



Model No. 2203-9

Unit illustrated is equipped with drive motor, column and ultra-sensitive dial indicator.

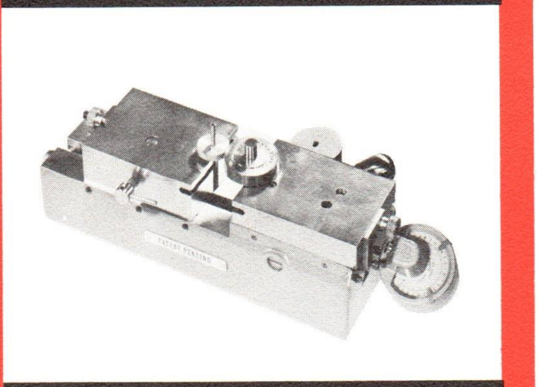
The basic model is designed to meet the needs for accurately checking ultra-precise fine pitch gears. It's a true precision instrument in every detail. Application of load pressures is accomplished with a unique beam and balance system permitting adjustments to fraction's of an ounce as required. Despite this sensitivity for the smallest fine pitch gears, the instrument is ruggedly stable, permitting consistently accurate checks day-in and day-out. The unit checks spur and helical gears by rolling with a suitable master. Recorded charts may be obtained with the addition of a bench type recorder. A right angle attachment provides a charter for checking worms and other right-angle gears.

The building-block design of the fine pitch unit permits purchase of accessory equipment as it is needed. A complete laboratory can be built around the basic unit as production orders require. In this manner much of the investment can be expensed as tooling for the job.

CAPACITIES	Model No. 2203-9
Maximum center distance	3″
Minimum center distance	¼″
Maximum straight arbor in "V" slides	½″
Minimum straight arbor in "V" slides	$\frac{3}{16}$″
Minimum center distance (Right angle attachment)	0″
Maximum center distance (Right angle attachment—½″ arbor in slide)	3″
Minimum center distance (Swivel head attachment)	$2\frac{5}{16}$″
Maximum gear diameter (Swivel head attachment ¼″ arbor in slide)	4⅝″
Adjustable floating unit spring tension	0 to 30 oz.
Throw-out unit for loading	$\frac{1}{16}$″
Length	17″
Width	7″
Height (with motor)	13⅞″
Weight	27#

Master gears are available in stock—Specials to order.
Misc. arbors, studs, pinion and rack holding fixtures—submit print of work gear.

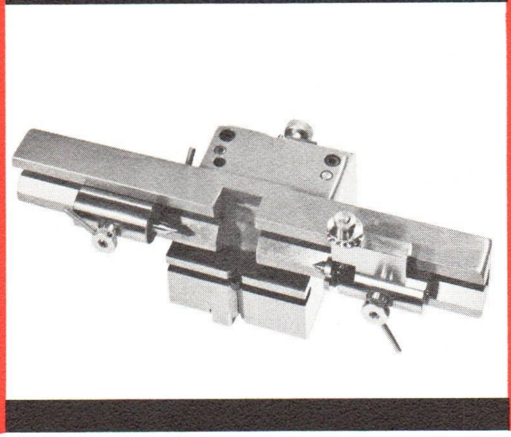
Fine Pitch Gear Rolling Accessories



THE BASIC UNIT
Checks spur and helical gears by rolling with suitable master

BENCH-TYPE ELECTRONIC RECORDER
It forms a precision fine pitch gear charter

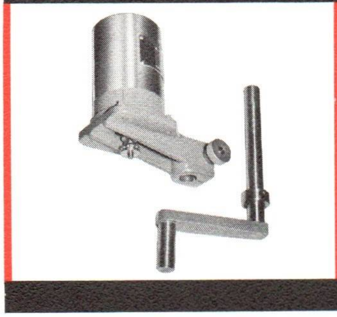
Stock accessories are readily interchangeable — can be added as need arises.



RIGHT ANGLE ATTACHMENT
Mounted to the basic unit, it checks worms and other right angle gears. Min. C. D. 0". Max. C. D. 3". Max. worm diameter 2". Maximum worm face at maximum diameter ⅞".

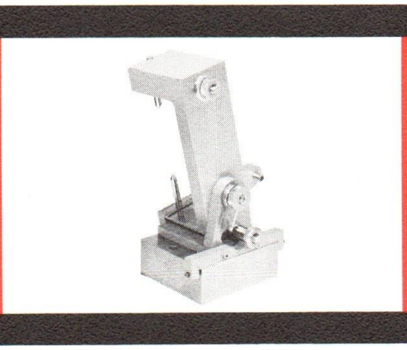
The 2203-9 basic unit is built to accept all the accessories shown as they are required. Parts are completely interchangeable and need not be ordered as a complete installation. This permits additions to the basic unit as production requirements demand.

Permits expensing these accessories as tooling for the job—saves investment capital for other gear laboratory requirements. Accessories are available to check the complete range of gears—spur, helical, worm, bevel etc.—a complete laboratory using one basic unit.



MOTOR DRIVE
Includes motor, mounting bracket and precision bead chain drive—provides power to master gear. Specify 60 rpm motor for use with right angle attachment—4 rpm motor for parallel axis checking.

COLUMN
Mounted on its own capacity slide—centers are "V" mounted for pinion gears with integral arbors. Centers can be removed and upper "V" adjusted to permit locating from bearing journals of the same or varying diameters. Min. C. D. ¼", Max. C. D. 3".

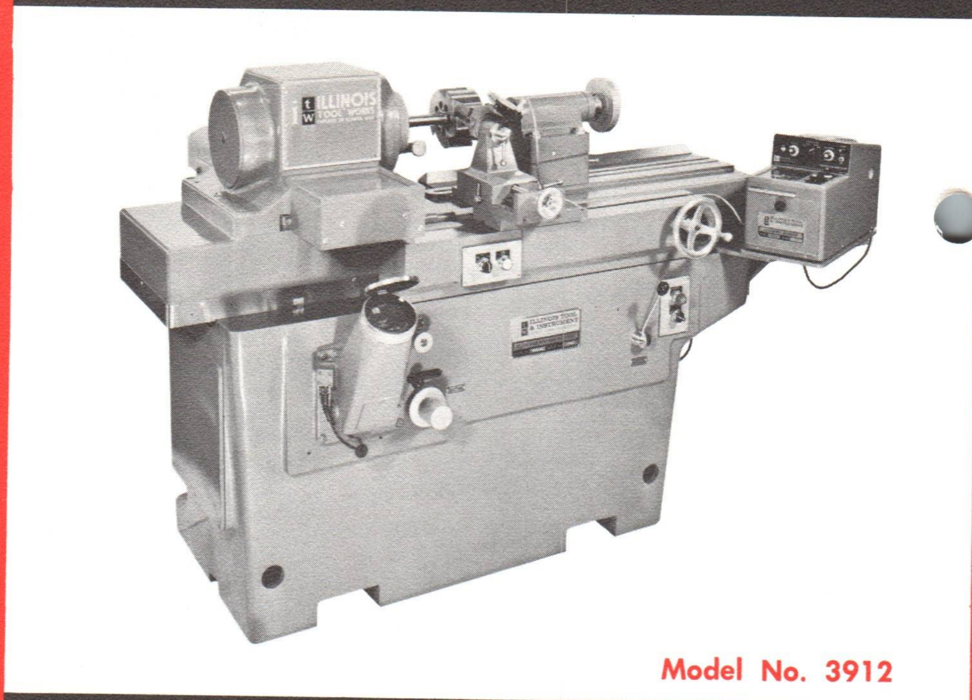


SWIVEL HEAD ATTACHMENT
Tips work gear permitting gear teeth such as worms and worm wheels to be positioned conjugate to master gear thread angle.

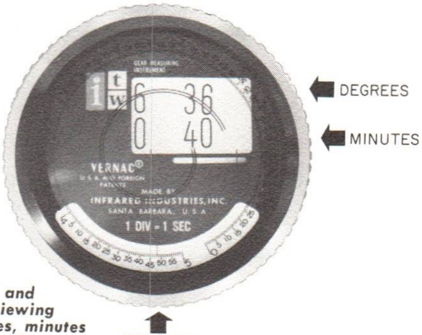
PRECISION DIAL INDICATORS
Wide selection of Reed-type "Mikrokators"—from .00001 to .0002 gradations. Total range from .0012 to .016 as required. Standard dial indicators also available.

Helical Lead Measuring Instrument

Large Screen, direct optical reading provides fast, accurate sine bar setting


Model No. 3912

Ease and simplicity of operation are the key features of the new ITW Helical Lead Measuring Machine. Previous set-up methods using gages requiring high operator skill have been eliminated. Setting is made through a highly accurate, large screen, direct reading optical device, which greatly reduces operator eye strain. Readings are given in degrees, minutes and seconds. Integral powered sine bar drive sets desired lead rapidly without manual effort. Instrument drive is designed so that either the table carrying the head and tailstock or the headstock spindle may be the prime mover.



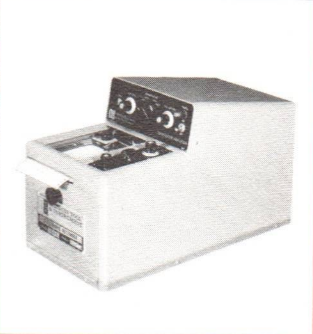
Readings magnified and transmitted to the viewing screen are in degrees, minutes and seconds. All readings are directly within the dial area.

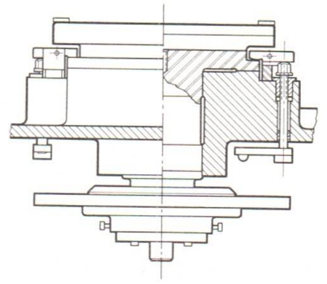
DESIGN FEATURES

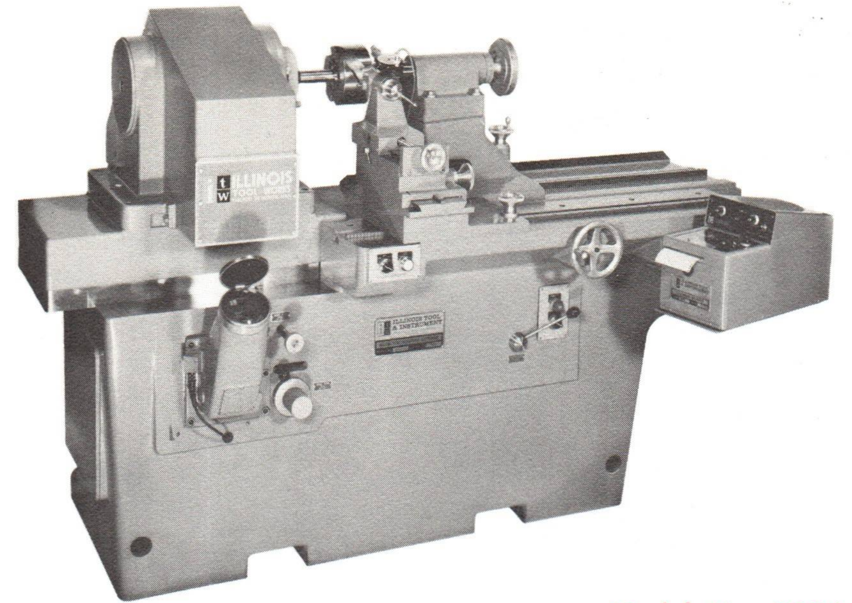
Vernac Optical Setting The sine bar setting is made through a direct reading optical device. Readings, from a precision 16″ graduated glass disc attached to the sine bar are transmitted through and magnified by the 40 power lens system unto the dial.

Compact, Reliable Electric Recording The standard helical lead measuring instrument can be equipped with integral electronic recording, without recording—using dial indicator only, or with a pick-up unit in the dial indicator for use with the ITW #1605 portable recorder.

Sine Bar Unit The sine bar is a separate unit mounted in the base of the instrument. Its purpose is to transmit an accurate angular measurement. After setting the sine bar to its proper angle via the Vernac, it is mechanically locked and essentially becomes an integral part of the base assuring absolute accuracy.




Side View

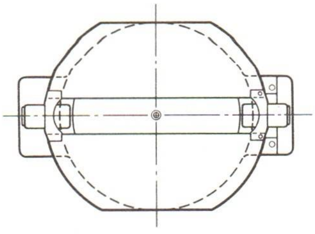


Model No. 3924

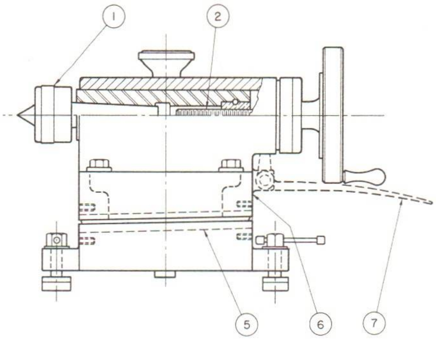
CAPACITIES	Model No. 3912	Model No. 3924
Nominal gear diameter	12″	24″
Minimum gear diameter	0″	0″
Maximum apron travel (with sine bar set at 0°)	8″	10½″
Maximum angular headstock rotation (with sine bar set at 90°)	140°	140°
*Maximum distance between centers	28″	36″
Minimum distance between centers	0″	0″
Maximum distance work can be checked from headstock center	18″	36″
Length	67″	82″
Depth	44″	48″
Height	47″	54″
Weight	4,350#	5,400#

*Capacity can be greatly increased by use of gooseneck or open end steady rest. Recommended accessory equipment will be quoted with every machine.

SINE BAR UNIT



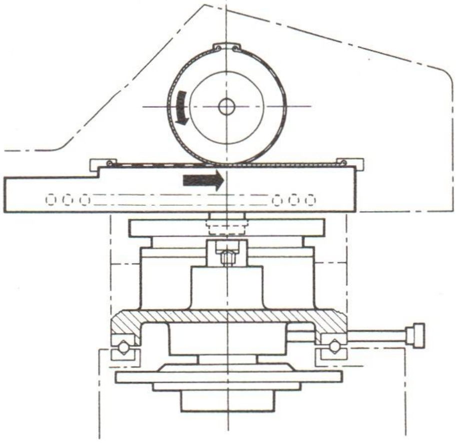
Top View



Tailstock The tailstock consists of a precision center (1) with screw type arrangement (2) for a axially moving the center into checking position. The tailstock assembly is furnished with a slip clutch handle which applies uniform pressure to the work part or with a quiet release lever (7) as optional equipment.

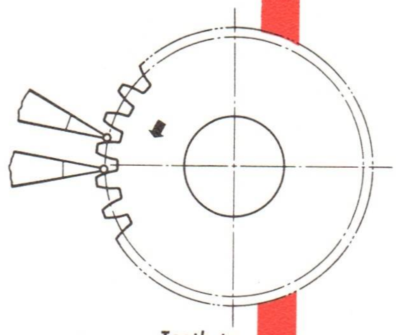
Headstock Correctly related motions of the headstock are transmitted directly from the sine bar unit—all connecting parts are mechanically banded for absolute rigidity—there cannot be any slip or backlash.

Instrument Drive The ITW helical lead measuring instrument drive is designed so that either the table or the horizontal cross slide may be the prime mover, depending upon length of lead. Unit can check leads from 0 to infinity.



Automatic Tooth Space Comparators

Model No. 3712


Tooth to tooth check

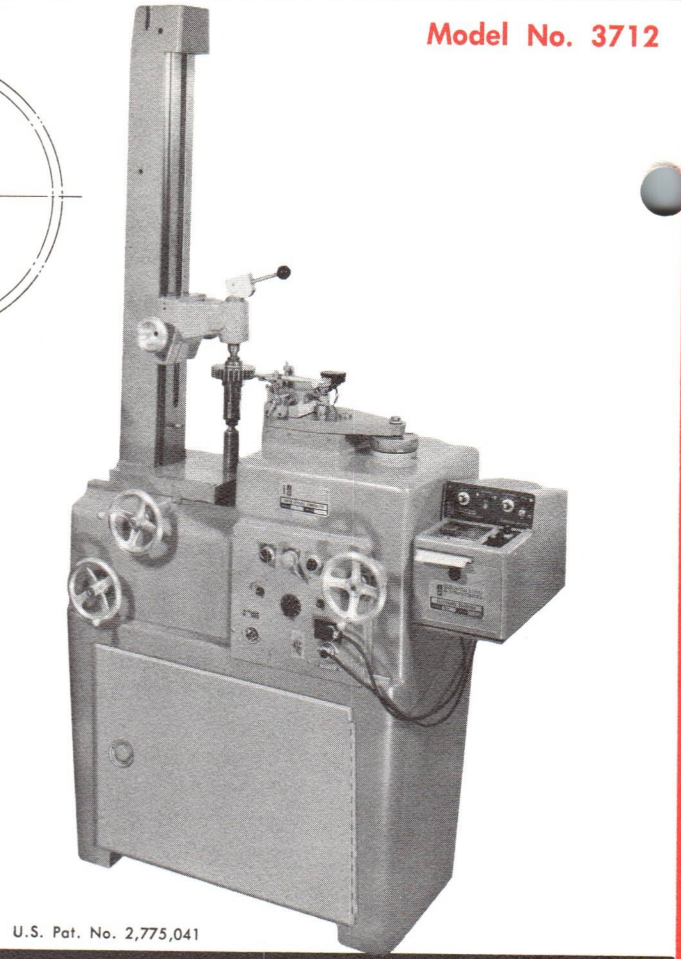
extremely versatile — simple finger variation permits checking . . .

- LEAD VARIATIONS
- ACCUMULATED SPACING
- TRUE INDEXING
- TOOTH THICKNESS VARIATIONS
- P.D. RUNOUT AND SIZE

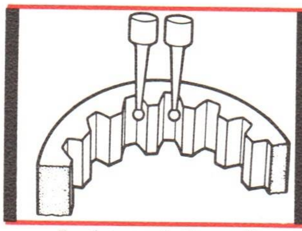
Tooth spacing is perhaps the most troublesome of all gear errors. Noise and variable tooth load are the result of poorly spaced gear teeth. Accurate checking is required to determine these errors.

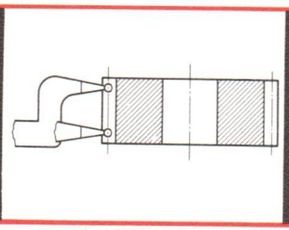
ITW's unique, continuous-action, tooth-to-tooth method is simple and automatic and permits the gear to be checked while in motion. Recorded chart reveals a true picture of spacing accuracy, and can be interpreted for accumulated spacing and maximum out-of-position errors in the teeth.

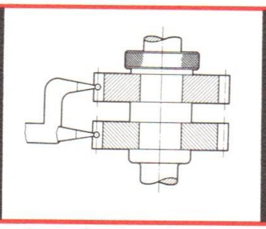
Unit is also ideal for checking spacing in master gears and gear shaper cutters, and other parts with tooth-like forms.

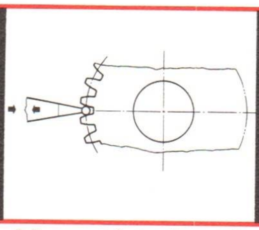

U.S. Pat. No. 2,775,041

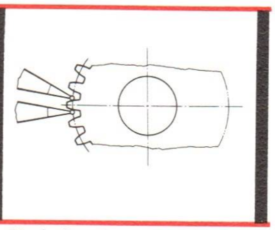
Inspect tooth-to-tooth spacing quickly, automatically without index plates or optics.


Tooth-to-tooth (internal)


Lead variation


Accumulated spacing check


P.D. runout & size from hole


Variations in tooth thickness

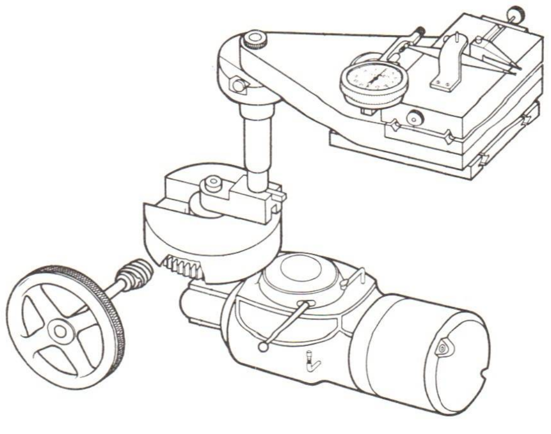
DESIGN FEATURES

An electronic recording system is built as an integral part of the machine, and lends itself ideally to the unique automatic mechanical arrangement which permits checking while the gear is in motion. The recorded chart reveals a true picture of spacing accuracy. The chart can be analyzed and interpreted to show the accumulated spacing and maximum out-of-position errors in the teeth.

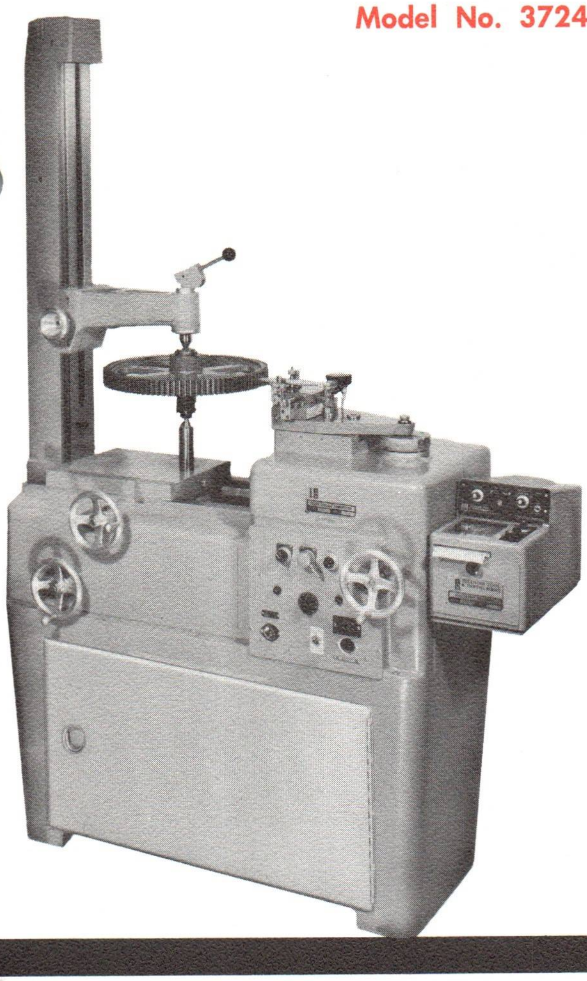
The automatic index and checking mechanisms shown at the right are mounted on ball bearings and ball races for accurate repetition and minimum wear.

A variable speed transmission makes it possible to operate at the maximum checking speed for a particular pitch.

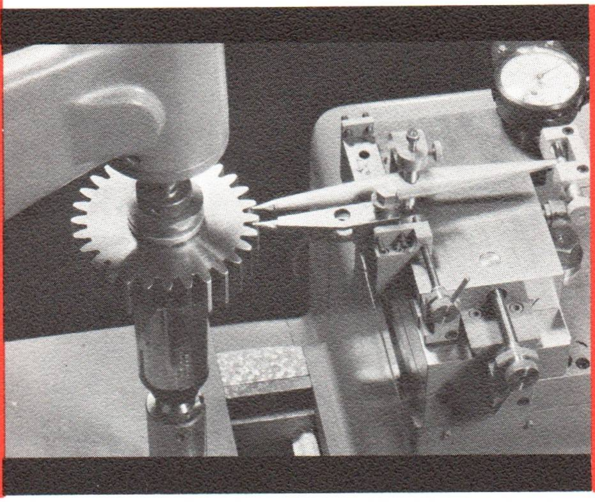
In addition to tooth-to-tooth spacing, the 3700 Series Tooth Space Comparator can make the many checks illustrated above using special and standard fingers, and special tooling.



Model No. 3724

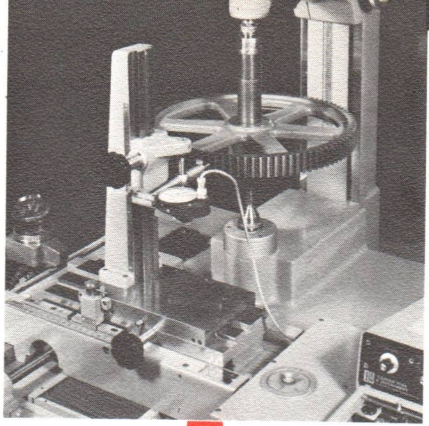


Close-up below illustrates the unique automatic feature of 3700 Series Tooth Space Comparators. 1/10,000 dial indicator is included to verify the recorder.



CAPACITIES	Model No. 3712	Model No. 3724	Model No. 3736
Minimum gear diameter	0″	0″	0″
Maximum gear diameter	12″	24″	36″
Maximum distance between centers	30″	30″	30″
Minimum distance between centers	0″	0″	0″
Maximum checking distance from end of shaft	9″	9″	9″
Finest pitch	64	32	32
Coarse pitch	2	2	2
Maximum weight of arbor and gear	250#	500#	750#
Length	45″	54″	65″
Width	23″	23″	23″
Height	85″	85″	85″
Weight	800#	1800#	2300#

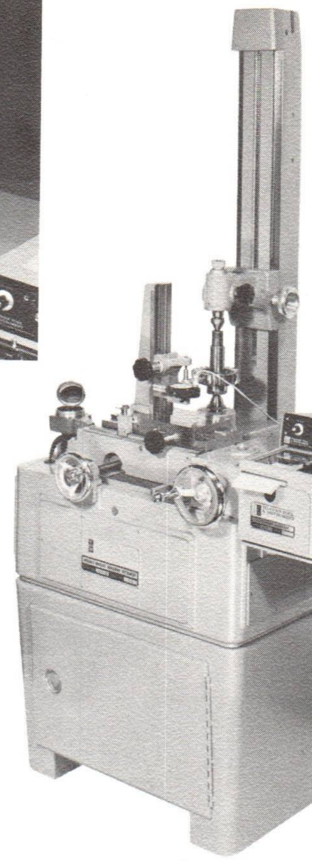
Variable Involute Profile Measuring Instruments



Close-up illustrates the operating features of the ITW 3424 unit.

The ITW Variable Involute Profile Measuring Instrument is a highly flexible, compact unit particularly adaptable to job shop application or in plants where a large variety of gears are produced. The unit requires no base circles in checking—base radius settings are made with the Vernac optical projector.

The instrument utilizes a large master base circle segment. For complete rigidity and total elimination of backlash, the master base circle is banded to the generating slide.



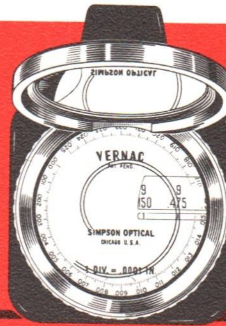
U.S. Pat. No. 2,787,060

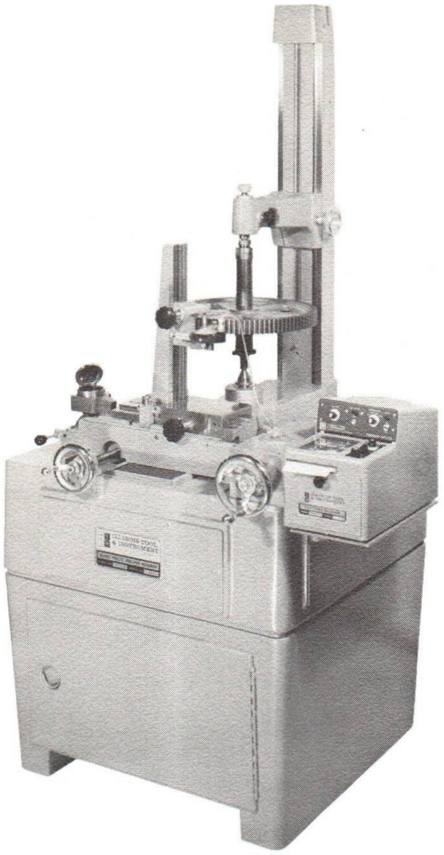
Model No. 3412

Units feature compactness — fast simple optical setting

Vernac Optical Setting For maximum ease in setting the variable ratio mechanism, a direct reading Vernac is utilized. Customary gage blocks, micrometer buttons, and dependence of operator skill in handling, have been eliminated. The large viewing screen saves operator fatigue—it is easily read without eye strain. The unit has low maintenance since there is nothing to wear.

New compact, solid-state Electronic Recording The 3400 series variable involute measuring instruments are available with or without integral recording. While integral recording is recommended as the most compact, and convenient package, the same accuracy and rapid response is available using the portable #1605 buggy-type recording unit. In either case, the recording unit is the same. The #1605 recorder is a solid-state instrument that requires no warm-up as would be necessary with tube-type amplifiers. Maintenance is considerably less since there are no tubes to burn out.





Model No. 3424

RATED CAPACITIES	Model No. 3412	Model No. 3424
Maximum gear diameter	12″	24″
Minimum distance between centers	0″	0″
‡Maximum distance between centers	30″	30″
Maximum indicator vertical travel	9″	12″
Maximum degree of roll	60°	60°
Maximum apron travel from either side of zero setting	4″	5″
Maximum Diametral pitch	2	2
Depth	33″	45″
Width	31″	36″
Height	83″	83″
Weight	2,100#	2,400#

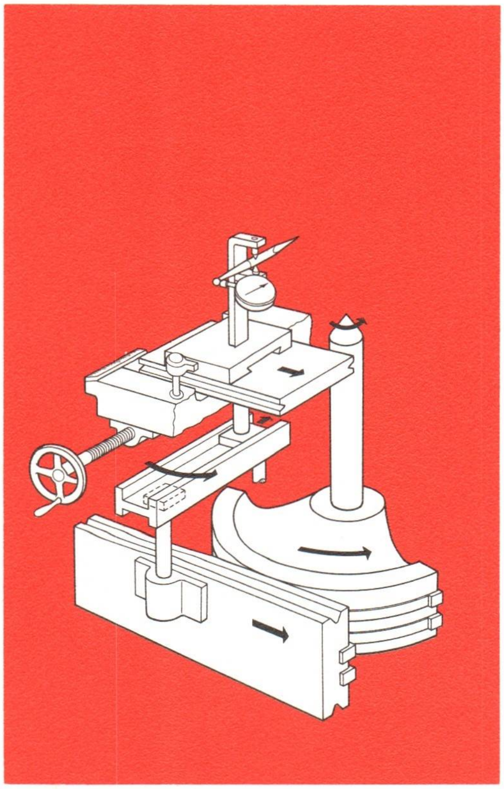
*Add 9″ for integral recording

Optional Equipment: Column and Overarm, Integral Recording.

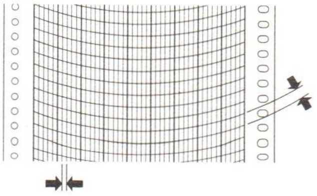
Recommended accessory equipment will be quoted with every machine.

‡Open end column & overarm for extremely long shafts available.

Simplified design features assure efficient, accurate response.



Instrument Drive The 3400 series variable involute drive system is simple and accurate, utilizing a minimum of linkage to assure excellent repeatability and simple setting of the ratio bar. All pivot points are directly on a common axis. The drive system uses the base circle principal common to the ITW Base-circle units. The only difference is that the variable unit incorporates a base circle segment as opposed to the complete disc and a ratio arm which provides the variable features of the instrument. The sketch at the left illustrates this principle. Note that the generating slide and base circle segment are rigidly banded for maximum accuracy and freedom of slipping.



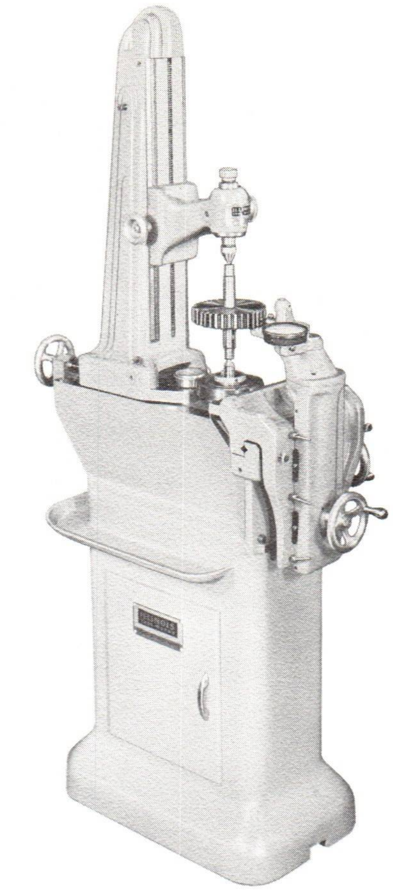
Paper Drive While recording, the Paper Drive moves the chart paper under the inking pen in timed relationship with the angular roll of the work spindle, so that paper travel is directly proportional to the rotation of the work or "degrees of roll."

→|← Space between vertical ruled lines represents:

.0004 at 200:1 magnification
.0002 at 400:1 magnification
.0001 at 800:1 magnification

Spaces between curved (horizontal) lines represent 1° of roll or 2° of roll of the gear being measured depending on whether paper drive is in high or low speed.

Base Circle Involute Profile Measuring Instruments

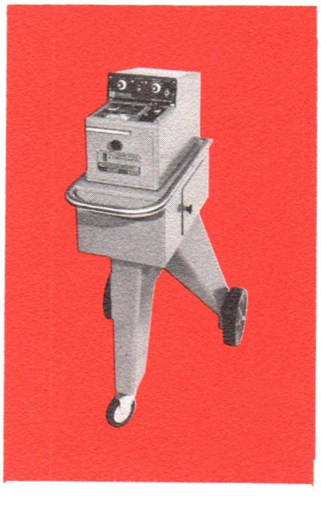


Ideal for long production runs — fast, simple, economical

The base circle-type involute checker is the most simple and theoretically the most accurate method of checking tooth profile, because the base circle eliminates any possibility of set-up error. The model features ease of operation and speed in checking. This unit is ideal for long continuous production runs of a single gear size and pitch. The hardened and ground base circle is the master gage against which the gear is checked. A base circle gage is required for each gear size.

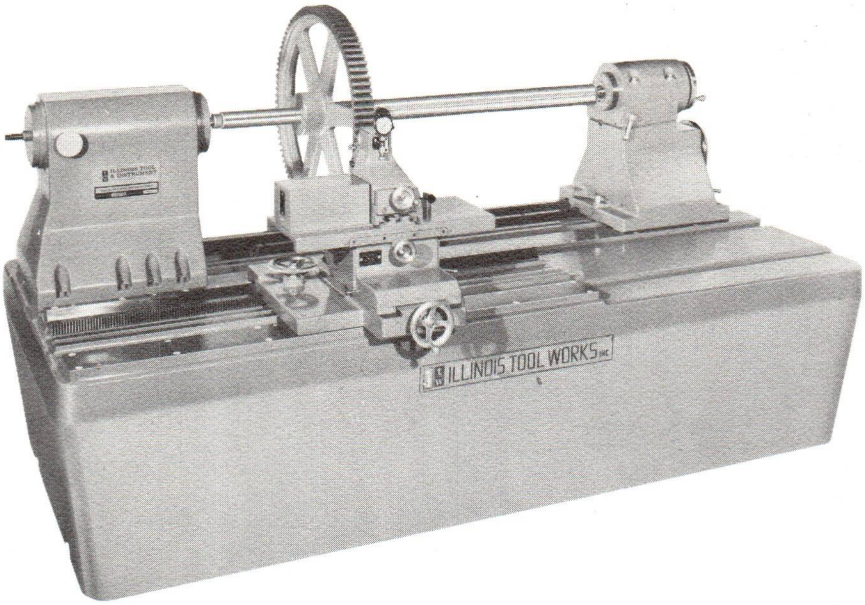
RATED CAPACITIES	2420	2430	2440	2450
Maximum gear diameter	12″	18″	24″	36″
Minimum recommended gear base diameter with standard lower center	2″	2″	2″	2″
Minimum recommended gear base diameter with special lower center	⅜″	½″	½″	2″
*Maximum distance between centers	18″	24″	30″	36″
Maximum vertical travel of indicator	8″	8″	12″	18″
Maximum travel of apron from either side of zero setting	3½″	4⅜″	5⅜″	8¾″
Maximum diametral pitch	2	2	2	1
Maximum recommended gear weight	500#	750#	1000#	1500#
Minimum distances between centers	0″	0″	0″	0″

*Open end columns and overarm for extremely long shafts and gears available. Recommended accessory equipment will be quoted with every machine.



ELECTRONIC RECORDING

The base circle involute checking instruments may be equipped with or without integral recording. The #1605 buggy-type recorder is most frequently used with this instrument. For details see page 9.



Parallelism and Tooth Space Measuring Instrument

Simplicity, Speed at Operation and Rigid Construction Keynote This ITW Precision Instrument.

The rugged, ribbed base casting and unusual length of the ITW Parallelism and Tooth Spacing Checker makes it a versatile instrument in checking work pieces at unusual size and weight proportions. Spur gears, splines, shafts, and anbors ranging from 3″ to 36″ are easily accommodated on this massive measuring instrument.

3800 SERIES

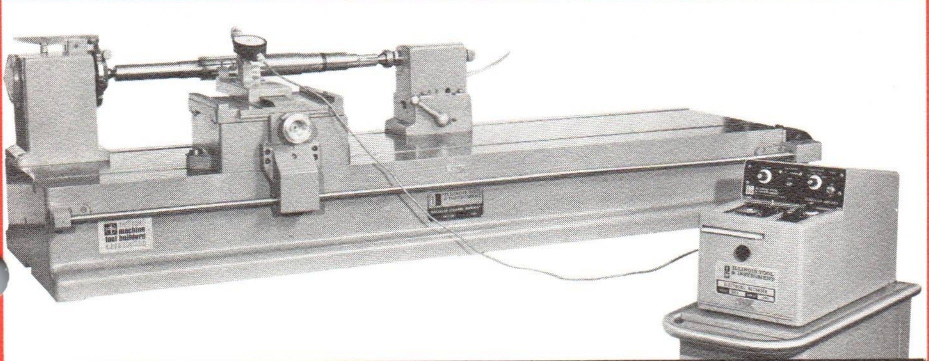
RATED CAPACITIES	Model No. 3800
Maximum checking length from head stock	30″
Maximum distance between centers	60″
Maximum work piece diameter	36″
Maximum checking length (indicator slide movement)	9″
Minimum work piece diameter	3″

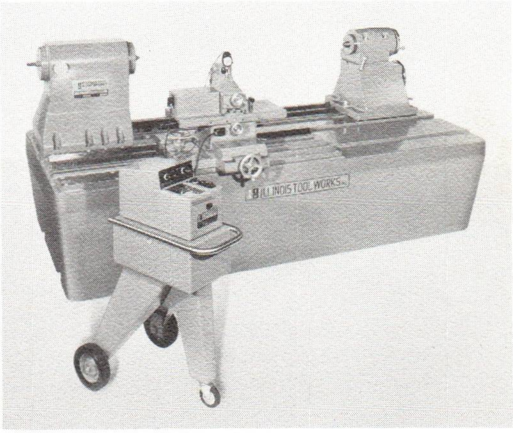
DESIGN FEATURES:

Recording The 3800 Parallelism and Tooth Space measuring instrument is equipped with a pick-up head in the dial indicator for use with 1605 Electronic Recorder or integral recording.

Tailstock The tailstock is equipped with ITW's standard clutching system for simplicity in positioning the work piece.

Headstock A braking device is incorporated in the Headstock design for complete precise work piece control.





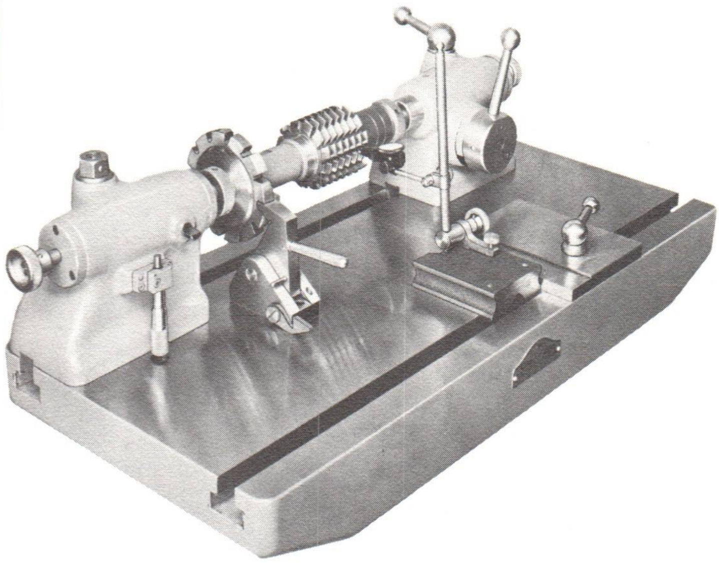
Hob and Cutter Sharpening Inspection Instrument

Eliminates wasteful use of improperly sharpened tools

This unit belongs in every tool room where hobs and cutters are sharpened. Placed next to the Sharpening Machine, this checker serves as an economical policeman to the cutter or hob grinder. Simple and easy to operate, the #265 inspects the following elements with very little time loss, and saves many gears or work pieces from the scrap pile:

1. Spacing of flute
2. Rake of flute—radial or hook
3. Parallelism of flute to axis of straight-flute hobs, or cutters. Also checks parallelism of keyways, splines, etc.
4. Runout of any parts that fit between centers
5. Lateral runout or wobble of any parts that fit between centers.

The savings with the use of this machine are obvious by eliminating rejected piece parts and time loss of production cut with improperly sharpened tooling. The #265 unit is built heavy and rugged for consistent checks over a long period of usage. Protected, continuous, full-length "T" slots are indicative of true precision instrument construction, and also permit "zero" center distance setting when required. Sliding guide plate is standard equipment.
Machine features simple one-hand indexing and hob or cutter rotation and eliminates the need for loose driving dogs. Time in operation is considerably reduced.



Model No. 265

RATED CAPACITIES	No. 265
Maximum diameter	8″
Minimum diameter	0″
Maximum distance between centers	12″
Length	27″
Width	12″
Height	12½″
Weight	390#

ACCESSORIES

A 5° angle block for checking spur shaper cutters is available. Special angle blocks are also available.

Index plates, arbors, indicators and stands are accessory equipment and are quoted to suit job requirements.

RIGHT
AND WRONG OF
MODERN HOB SHARPENING

ILLINOIS TOOL & INSTRUMENT

Send for free copy

Illinois Tool Works booklet "Right & Wrong of Modern Hob Sharpening" gives excellent tips for effective tool maintenance. Write:

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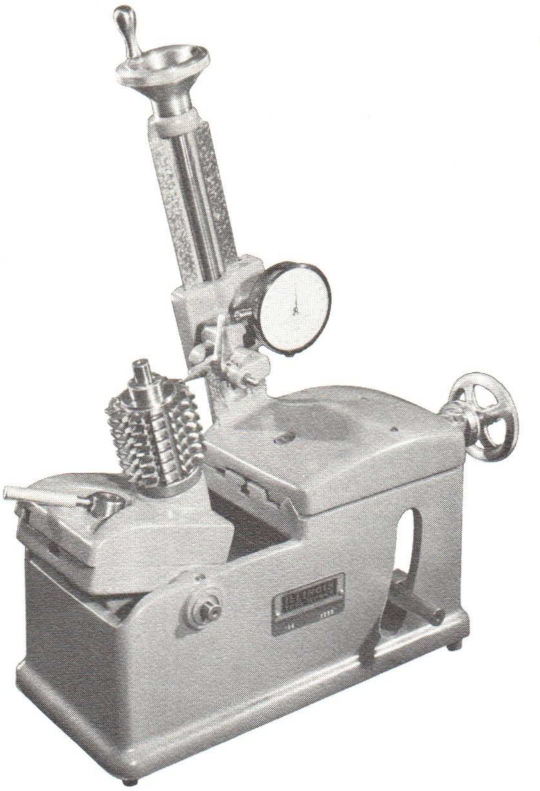
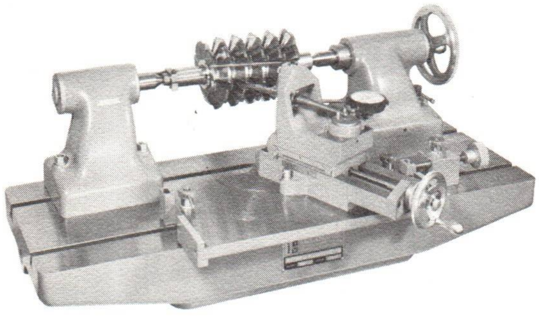


Model No. 188



Model No. 1812

Hob Contour Measuring Instruments

Hob contour measuring instruments check hob tooth profile in the axial plane quickly to .0001″

Efficient large quantity users of hobs realize the important savings effected through complete and systematic tool control. The element of hob tooth profile, especially with hobs having tip relief, fillet or profile modifications, can be checked on a Hob Contour Measuring Instrument. The ITW #188 unit makes this geometrically complicated check quickly and easily in the axial plane to .0001″. Utilizing the sine bar principle, the #188 is ruggedly and precisely built to precision tolerances for consistent day-in and day-out checks.

In addition to the standard 6″ diameter capacity unit, a newly designed 12″ diameter capacity instrument holds the hob between horizontal centers which permits checking both sides of the profile without handling very large hobs.

RATED CAPACITIES	No. 188	No. 1812
Maximum hob diameter	6″	12″
Minimum hob diameter	0″	0″
Maximum hob length	6″	15″
Distance between horizontal centers	—	20″
Maximum pressure angle — right and left	30°	45°

Hob and Worm Lead Measuring Instrument

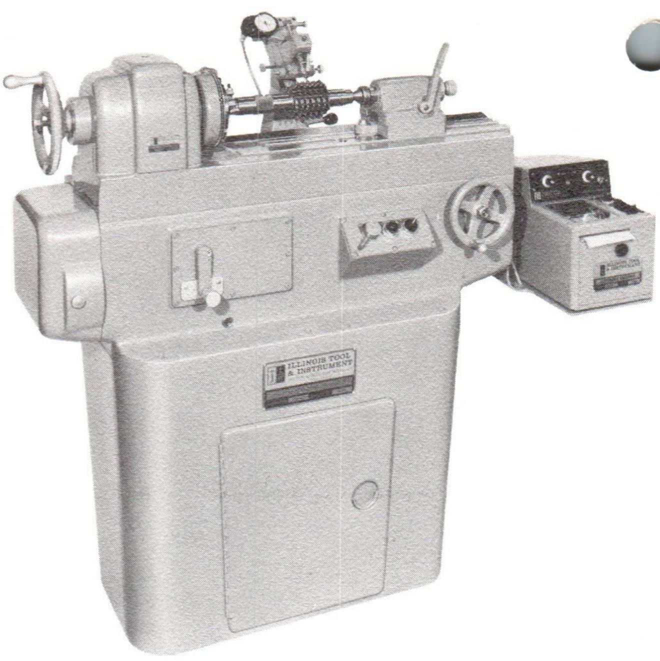
The famous ITW 1731 sets the standard for the hob industry . . . the Toolgraph® Chart

The 1731 measures and charts the lead error on both hobs and worms. Checking the lead of a hob thread is particularly important since it directly affects the involute of a gear tooth. It is very important when the hob is used on a machine with an automatic shifting device. Hobs with thread weave often produce good gears at one end and poor gears at the other. Hobs with such weave should not be used.

It is the #1731 that produces the "Toolgraph Chart", the hob user's guarantee of hobs with accurate lead. Used with recording, the 1731 produces a visual chart of hob or worm lead errors.

RATED CAPACITIES	No. 1731	No. 1715
Maximum diameter	6″	15″
Minimum diameter	0″	0″
Maximum lead	2″*	6″*
Minimum lead	.050″*	1″*
Maximum distance between centers	16″	24″
Maximum checking distance	6″	19″

* Other special lead capacities are available.

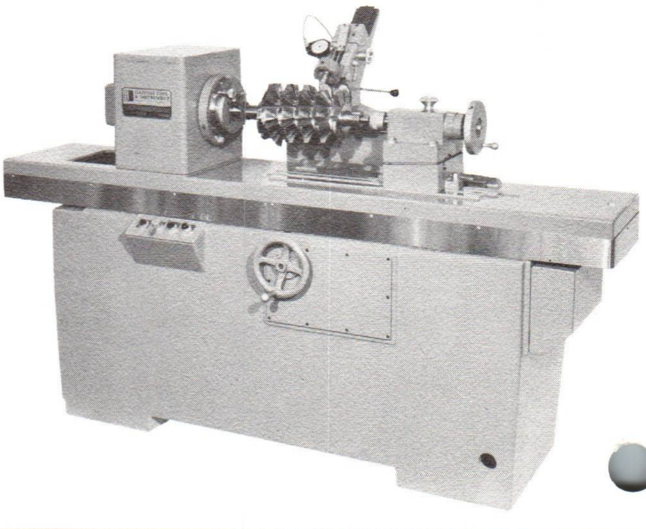


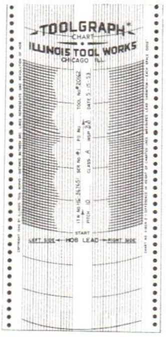
NEW! ITW model #1715 large capacity hob and wo lead measuring instrument.

Basically, the #1715 is similar to the #1731 in that it provides the world famous ITW "Toolgraph Chart" . . . a visual record of hob lead variations.

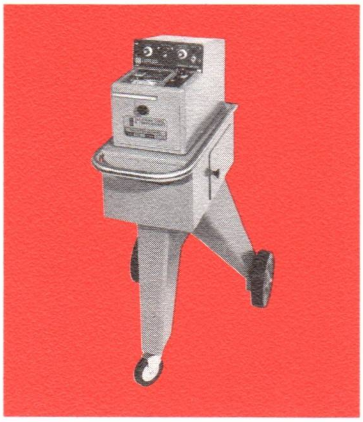
The outstanding feature of the #1715 is its 15″ maximum diameter capacity (see rated capacities chart for additional comparative data).

For the first time, the #1715 offers manufacturers and users of large diameter hobs and worms an accurate check of lead variations.



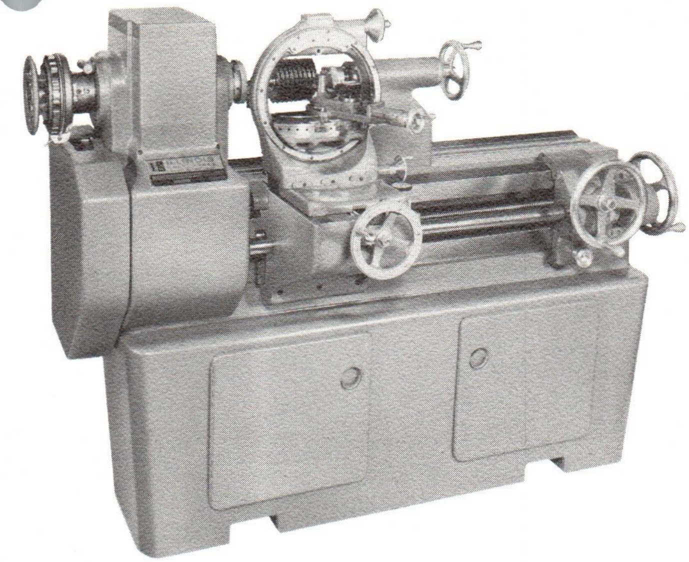


World Famous ITW "Toolgraph" Chart. Certificate of hob accuracy.



The 1731 and 1715 are available with or without integral recording. Equipped with pickup head, the unit can also be used with the 1605 portable buggy-type recorder.

Model No. 436

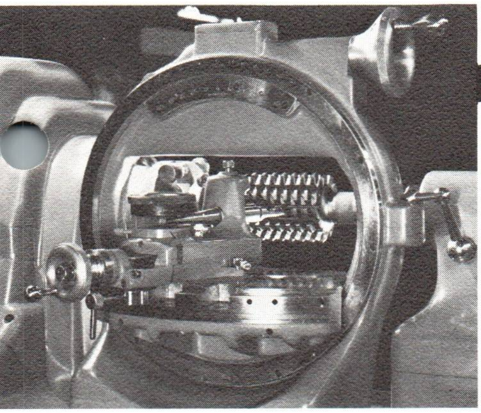


Universal Hob & Worm Measuring Instruments

check all essential elements of hobs and worms to 15″ diameter

This unit is designed to check the important elements of lead and shape of worm threads. It is possible therefore to compare the worm directly with the worm wheel hob and insure production of worm gears that will operate smoothly, quietly and efficiently.

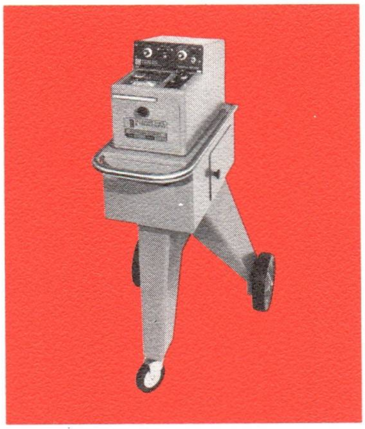
In addition, this machine can check every element of hobs—combined with electrical recording, the unit is truly universal in nature and is an excellent addition to a complete gear laboratory.



Close-up shows unique swivel head which permits checking in either the axial or normal plane.

RATED CAPACITIES	No. 436
Minimum recommended lead check	.200″
Maximum lead check	15″
Minimum diameter	0″
Maximum diameter	15″
Distance between centers	30″

Motorized drive can be added as accessory equipment



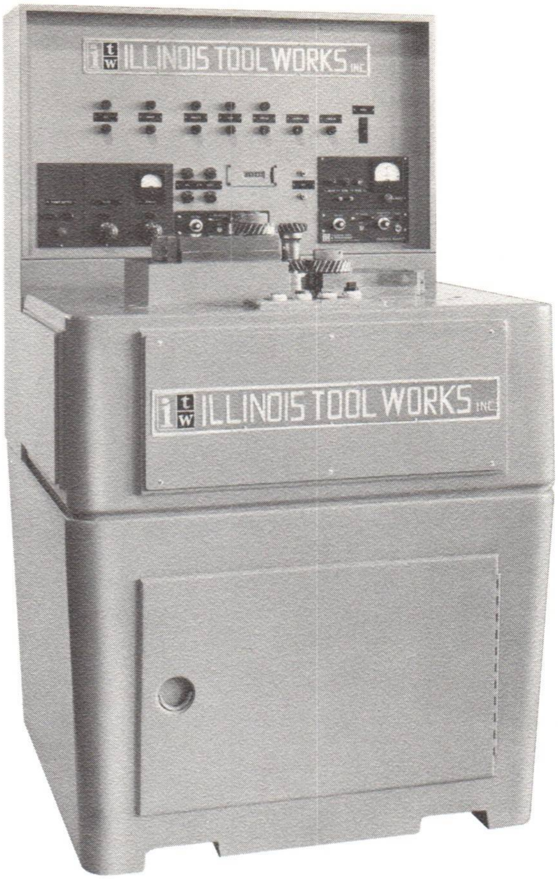
The 436 is readily equipped with pick-up head to chart readings using the #1605 Electrical Recorder.

Semi-Automatic Gear Measuring Instruments

A completely new approach to parallel axis gear checking speeds production—assures reliability.

The semi-automatic gear measuring instruments shown on these pages are specifically designed to inspect gears scheduled for continuous production runs. They incorporate all the elements of single station automatic gear checking, except that they are manually loaded. Semi-automatics are special gear measuring instruments, assembled on the building block principle, with standardized parts. They are most useful for checking cluster and shaft gears which are not readily adapted to automatic loading.

Electronics permits the breakdown of a composite functional check into individual elements of size, runout, tooth-to-tooth spacing and nicks. In addition, it does it quickly and impartially. It eliminates the possibility of human error in judgment. Audible or visual signals on the unit panel determine whether the gears pass or fail the predetermined tolerance tests.



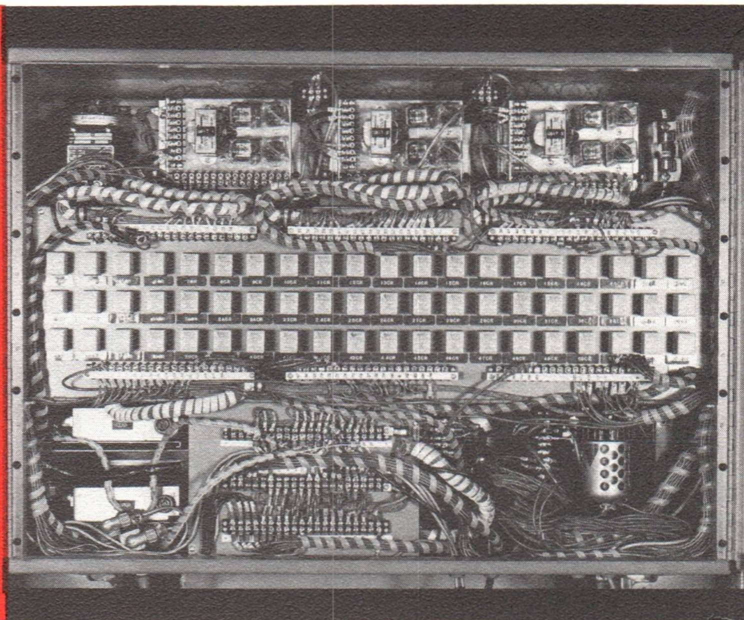
NEW DESIGN FEATURES:

New improved models have slower rotation speed permitting less master gear wear.

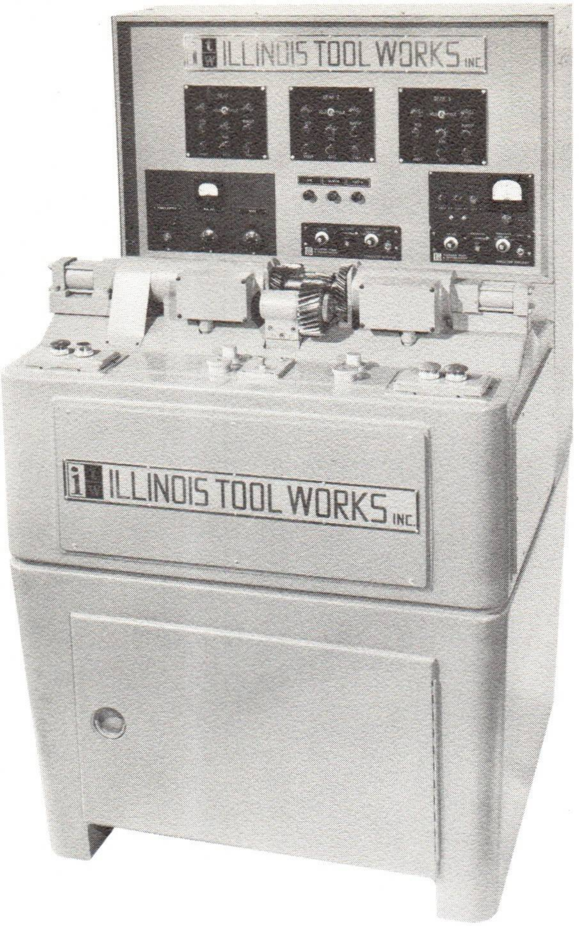
Safety clutch on master gear drive automatically retracts when error signal on previous station is activated to reduce master gear wear.

Standard 1605 Electronic Recorder can be plugged into panel for making a composite chart and facilitating set up or analysis.

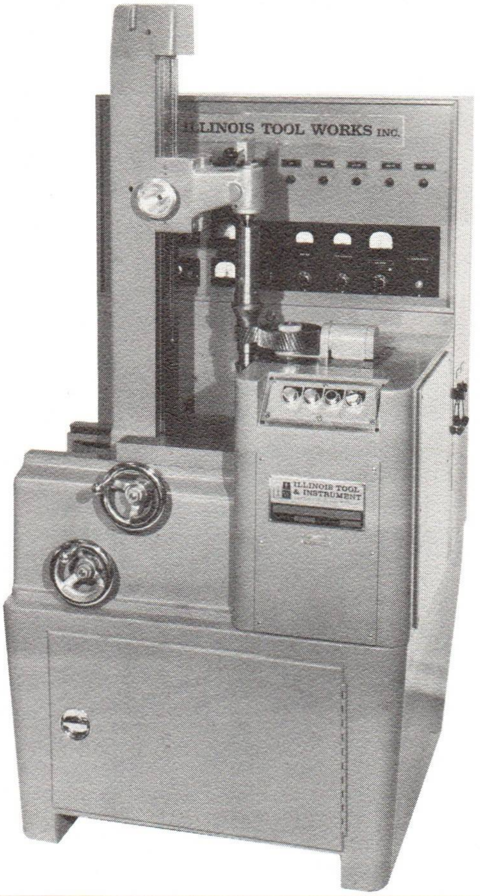
Standard Amplifiers and electronic components are utilized.



Close-up of electronic panel illustrates readily exchangeable standard component design.



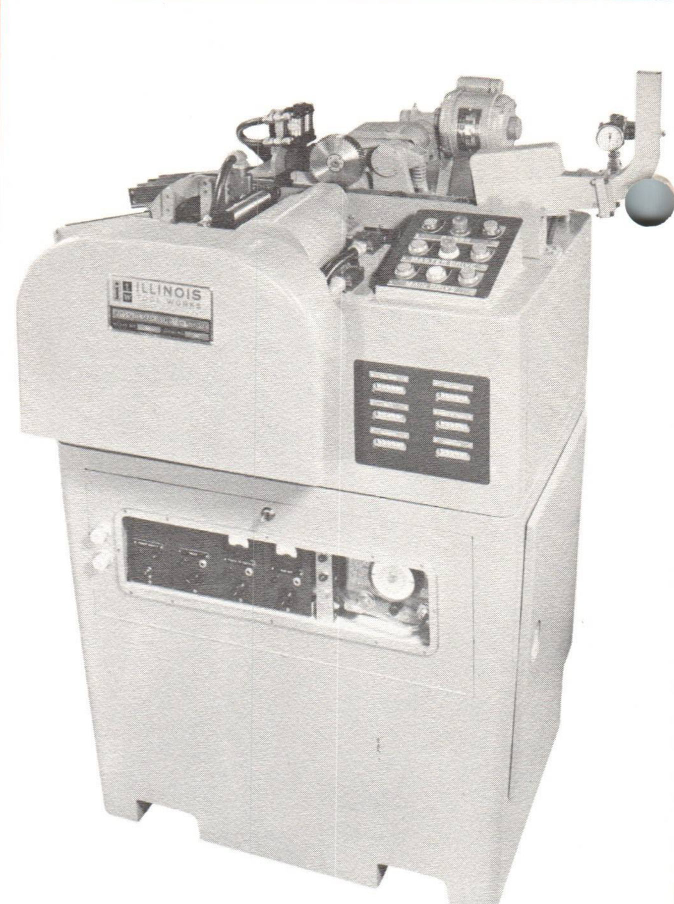
Instrument above shows an excellent application of Semi-automatic gear checking.



Units above illustrate normal semi-automatic gear checking. Instrument, at right utilizes arbor-type arrangement.

ITW® Automatic Gear Measuring Instruments

NEW! SOLID STATE AMPLIFYING AND SWITCHING CIRCUITRY UTILIZING INTEGRATED CIRCUIT BOARDS NOW AVAILABLE WITH FINAL GEAR INSPECTION UNITS.



U.S. Pat. Nos. 2,959,282, 2,965,971

Single station automatic gear inspector checks gear for size, runout, tooth-to-tooth variation and nicks. Loads and sorts gears automatically.

Complete final inspection at 100% efficiency — up to 800 pinion gears per hour

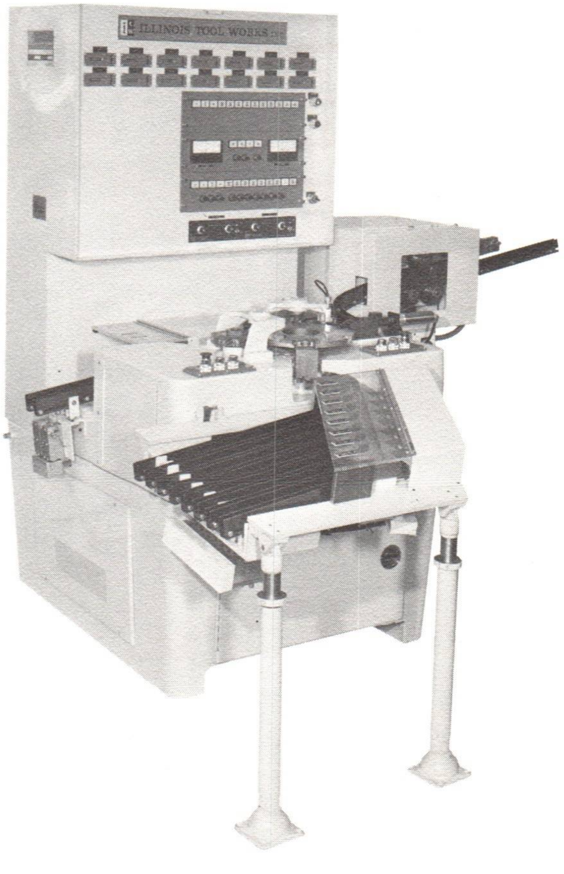
ITW automatic gear measuring instruments are specially engineered to the application. They are built on the building block principle with one or more stations incorporating the elements of simple functional gear rolling instruments, velocity-type pick-up, electronics and automatic loading.

Automatics are particularly adapted to small bore-type gears of high production quantities, since these are readily automatically loaded.

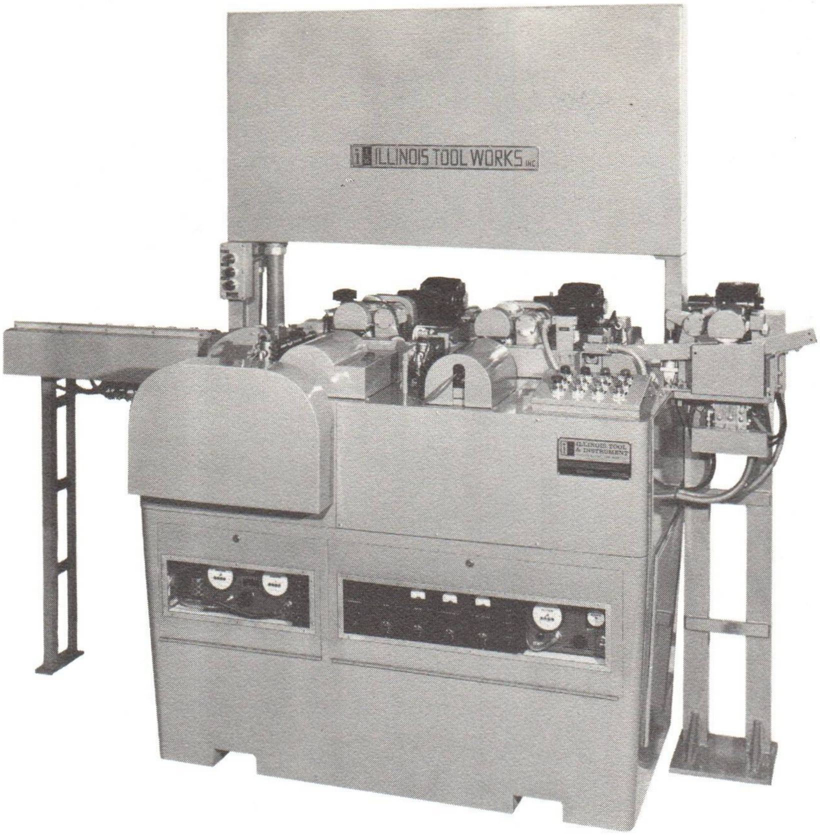
Single station instruments check runout, gear size, tooth-to-tooth variations and nicks. Electronics permits the separation of the composite check into the various elements named.

More sophisticated automatics are built with up to 3 checking stations. With the aid of scanning, special-purpose masters, these stations' composite checks duplicate the gear as it would roll while at work. Master gear modifications tend to isolate troublesome gear errors and give indication of lead, involute, angular velocity, taper and wobble errors.

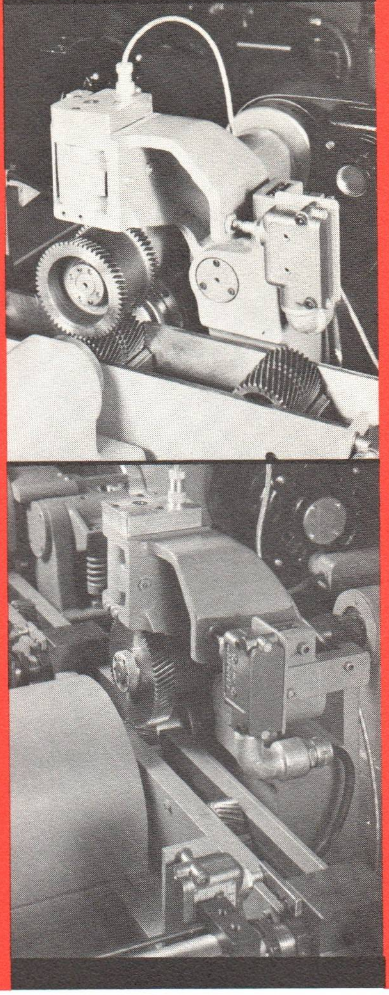
Electronic signals caused by gear wobble and or center distance variations between master and work gear are received by a velocity pick-up and fed into an electronic amplifier—amplified currents in turn control relays, counters and reject chutes. Gears are sorted as accepted, rejected, salvageable (nicked) and graded into size classifications within tolerance limits prescribed by engineering.



Rotary final inspector utilizes turntable principle, with up to 5 separate stations possible. The rotary uses a memory system which directs gears into their proper chutes after the entire cycle is completed. Units of this type can process up to 800 pinions per hour. As many as 10 separate checks can be made on this instrument.



Multiple-station automatic using the in-line principle. Gears are fed via conveyer through the chute into each station successively. Unit incorporates both functional and scanning master gear stations. 3 Stations are possible on the in-line instrument.

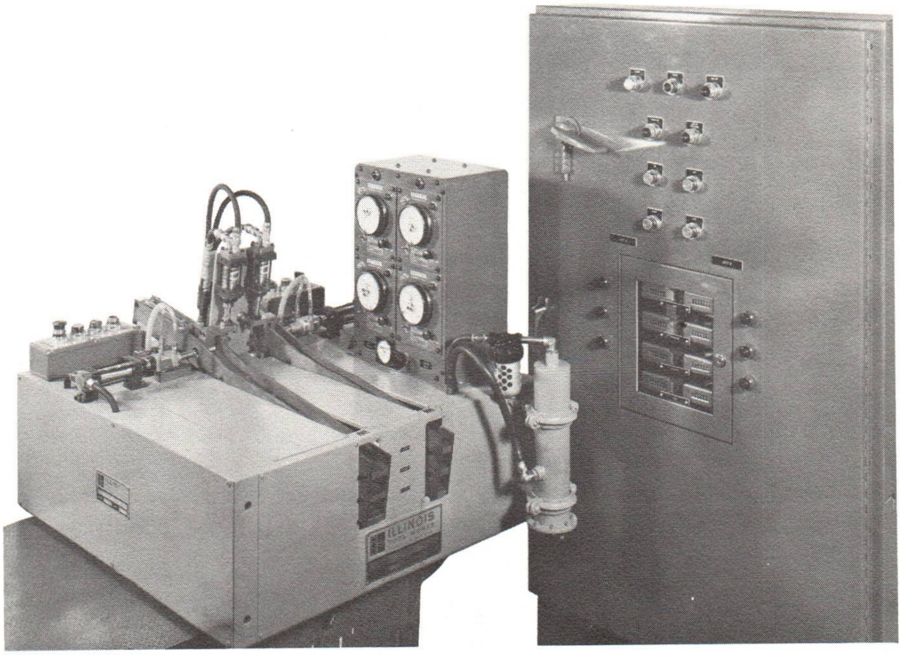


Close-up shots above illustrate two types of scanning master gears. Note split master at top. These shots also illustrate conveyer system and chutes which feed gears in timed relation to the checking stations. Air powered cylinders place work gear on arbor for checking.

ITW Automatic Instruments can make the following checks

- **Scan the lead**
- **Scan the involute**
- **Runout — the most persistent contributor of gear errors**
- **Angular velocity**
- **Nicks**
- **Size**
- **Taper**
- **Wobble**
- **Bore Size**
- **Gear Length**
- **Tooth-to-tooth variations**

The automatic bore size checker is a simple air gaging probe. Panel permits remote control over operation — keeps numerical count of rejects and categorizes for statistical study. Unit also controls production machines — stopping these when percentage of rejects exceeds tolerable limit.

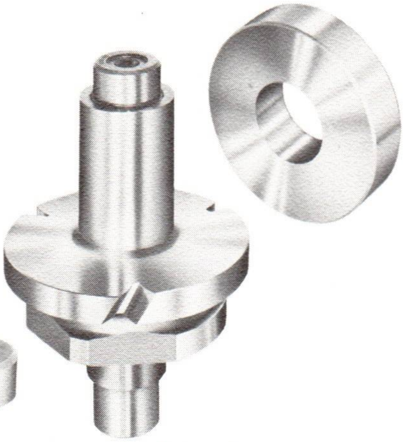


itw® Master Gages

Master Gages for Illinois Tool Works Measuring Instruments are used to verify and control accuracy. Precision master gages have one or more gaging surfaces which may be straight or curved. Their application may vary from measuring a simple angle to checking a complex motion. Gaging surfaces are the most efficient and accurate means of verifying the accuracy of precision checking instruments. For practical use, the gages are made with a small, known deviation from the theoretical to create a movement in the indicating or recording system of the instrument.

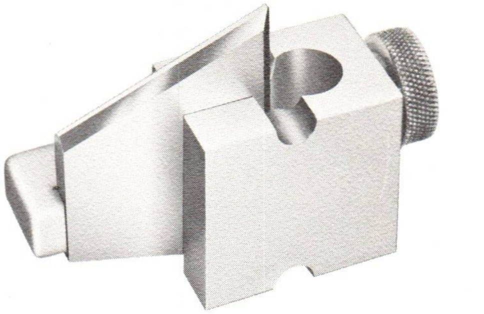
Measuring instruments should be periodically checked against their proper master gage to maintain maximum operating accuracy. A complete line of specially designed gages has been developed by Illinois Tool Works for its measuring equipment.

Special shapes and configurations will be furnished as requested.

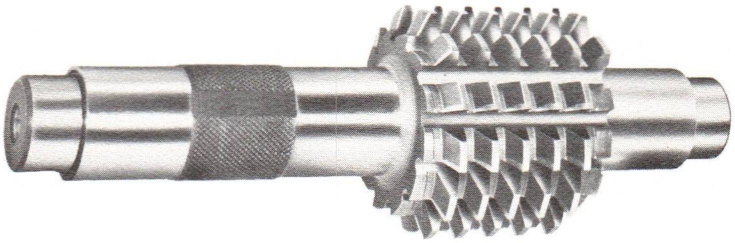


Involute master gage and base circle for involute instruments.

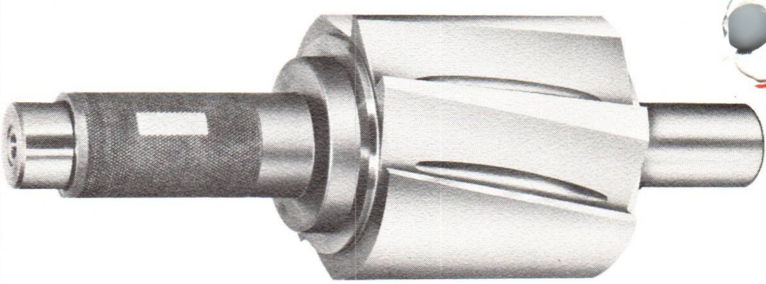
Finger centering gage for involute instruments.



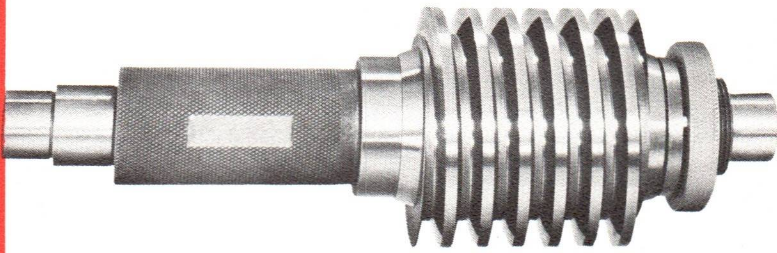
Pressure angle master gage 14½° and 20° P.A. standard for hob contour instrument.



Hob lead master gage .500 lead-12-gashes, for hob and worm lead instruments.



Helical lead master gage with 4 leads for helical lead measuring instruments.

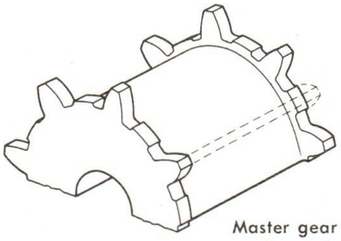


Worm lead master gage .500 lead for hob and worm lead instruments.

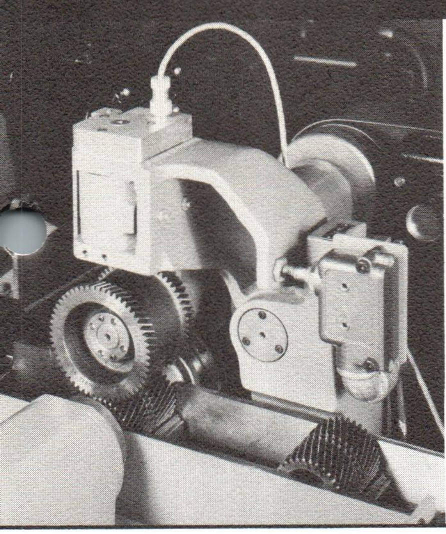
itw® Master Gears

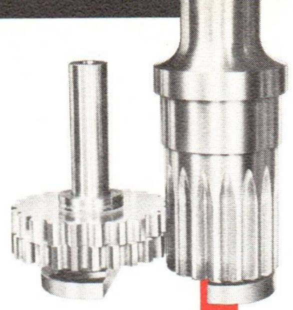
Illinois Tool Works manufactures a wide variety of both spur and helical Master gears to fill every gear and spline gaging requirement. In addition, many unique special purpose Master gears have been developed. A few of these are illustrated. Masters can be furnished from 4 to 120 D.P. and in almost any pressure angle, and popular pitches are carried in stock. When ordering Master gears, please submit part prints or complete gear specifications.

Write for listing of stock Master Gears.

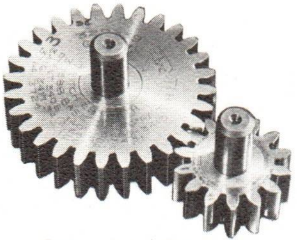


Master gear for checking straightness and parallelism of spur gear teeth*



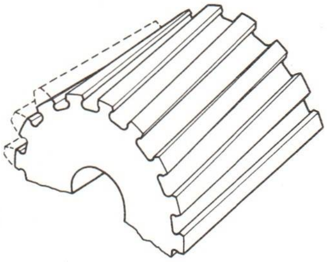


Involute Spline Master Gears U. S. Pat. No. 2,726,455



Conventional Spur Master Gear

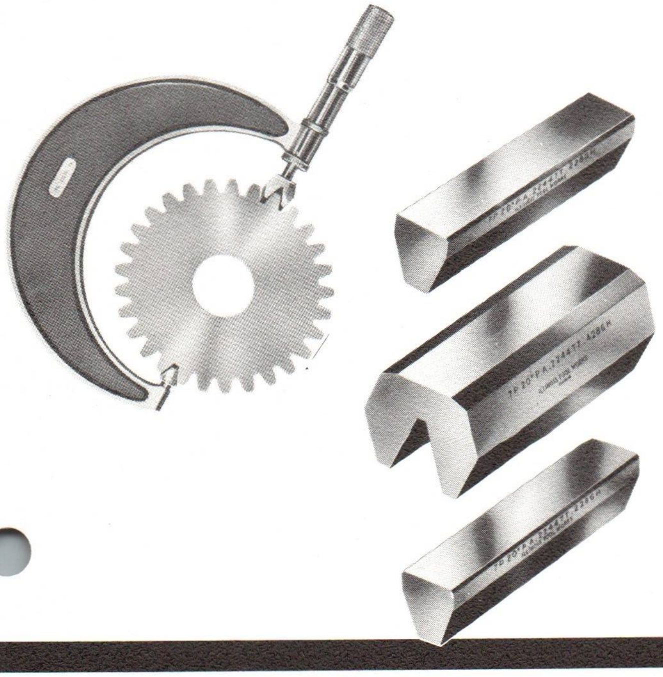
Lead master gear contacting work gear near O.D.*



Helical carry-over master gear*

*U. S. Pat. No. 2,780,007

itw® Gear Measuring Blocks



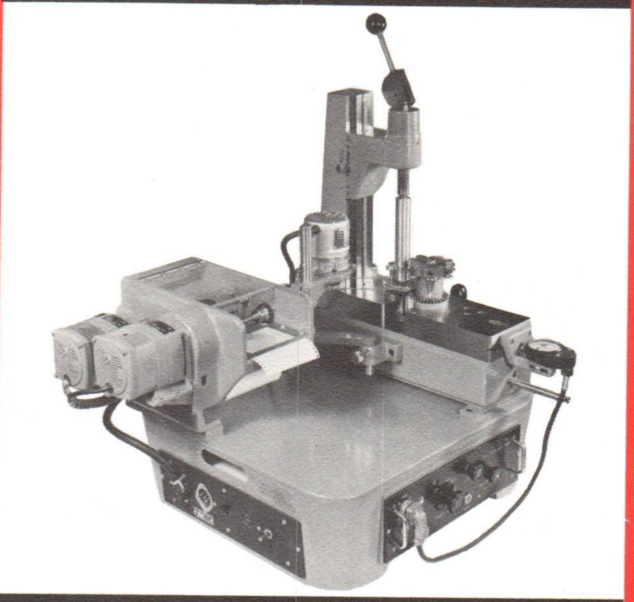
Illinois Tool Works gear measuring blocks are used to determine correct pitch diameter size of the gear. They have been designed to eliminate the common shortcomings of ball and wire measurement. The blocks are theoretical rack teeth of known proportions and are made to exact tooth thickness and pressure angle of each pitch.

Each set consists of three blocks, two male and one female, and is made to specific pitch and pressure angle. Two male blocks are used to measure gears with an even number of teeth. The combination of one male and one female block is used to measure gears with odd number of teeth.

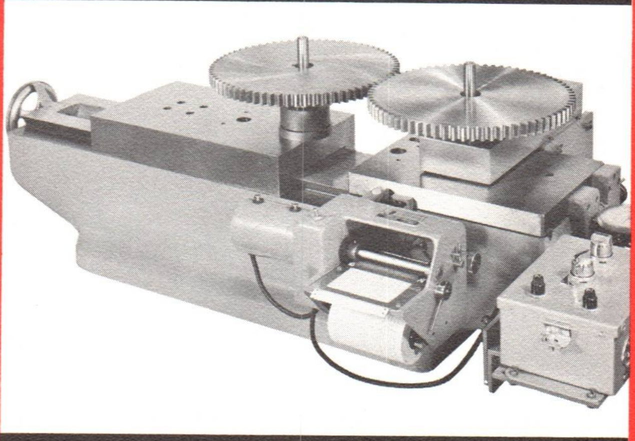
Blocks are machined with large flat top surfaces providing flat, parallel seating for micrometer anvils. For complete information send for detailed data sheet No. AD-51.

Modified **Standard** Gear Measuring Instruments

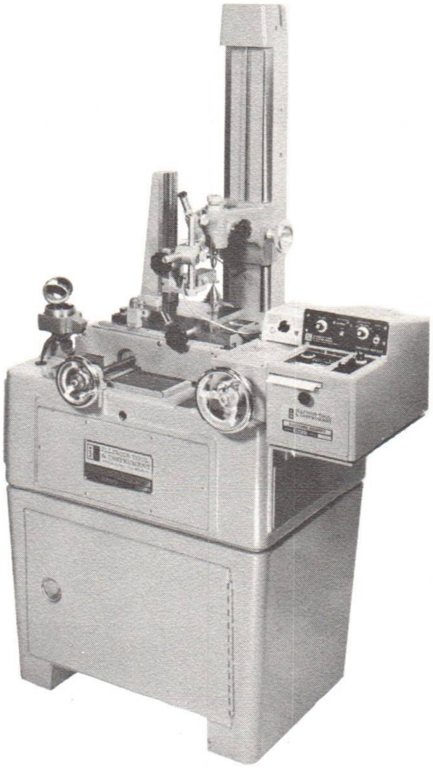
The measuring instruments on this page are modifications of standard equipment for special purpose applications. Modifications are possible on most standard equipment to serve specific need. Ask about these possibilities—quite frequently considerable savings can be realized over specially built instruments.



This universal joint detail charter offers excellent example of how ITW gear measuring instruments can be adapted to check gear-like parts.
Unit incorporates motorized and electronic recording with Standard 2206-1 parallel axis gear rolling instrument.



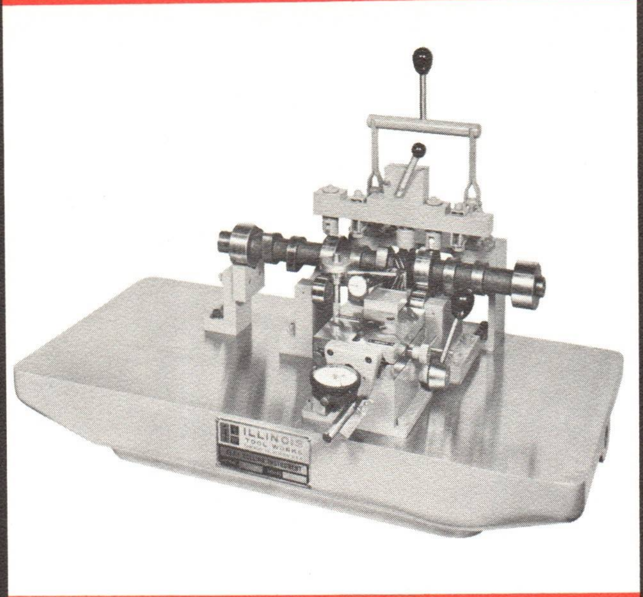
A standard 15" capacity handroller equipped for mechanical recording and motor drive. Special control box readily accomplishes this purpose.



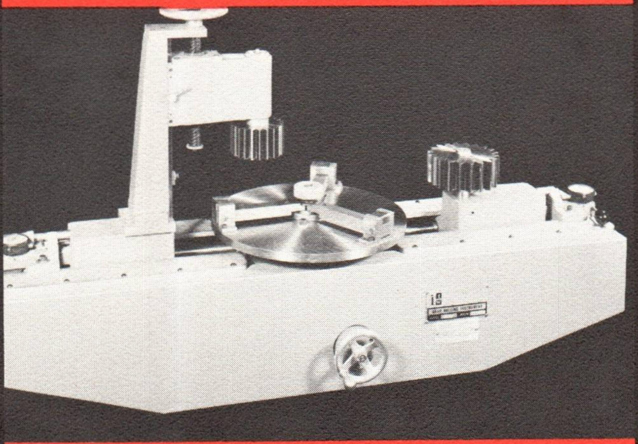
Standard variable involute instrument tooled specifically for fine pitch gears. Scope is used to set-up finger engagement. Ultra-sensitive cartridge-type pick-up permits checking with very light loads.

Special Measuring Instruments

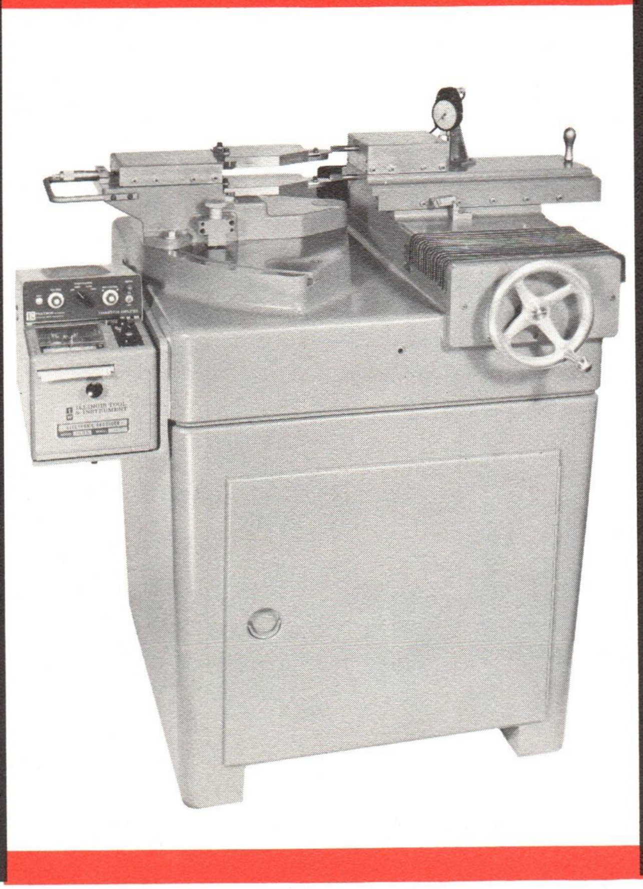
The instruments illustrated here are specially built to satisfy a particular requirement. They are shown only as typical examples of the wide variety of measuring instruments built by ITW. While most of these relate to gears or gear-like parts, ITW instruments can perform many measuring or inspecting operations. We welcome your inquiry.



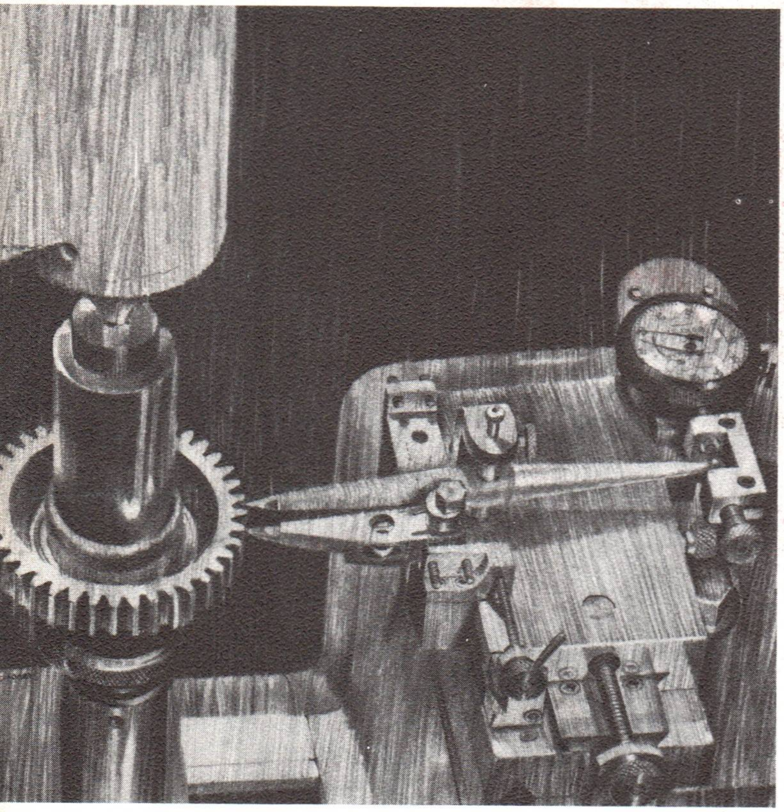
Special cam-shaft measuring instrument specially tooled to measure the timing gear.



Special handroller built for very large diameter gears. Unit combines both internal and external gear checking on a single unit.



This special instrument was designed to measure inserted blades for cutting tools. A true comparator, the unit measures against a master blade for correct tooth form.



ILLINOIS™ METAL CUTTING TOOLS

ILLINOIS TOOL & INSTRUMENT

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